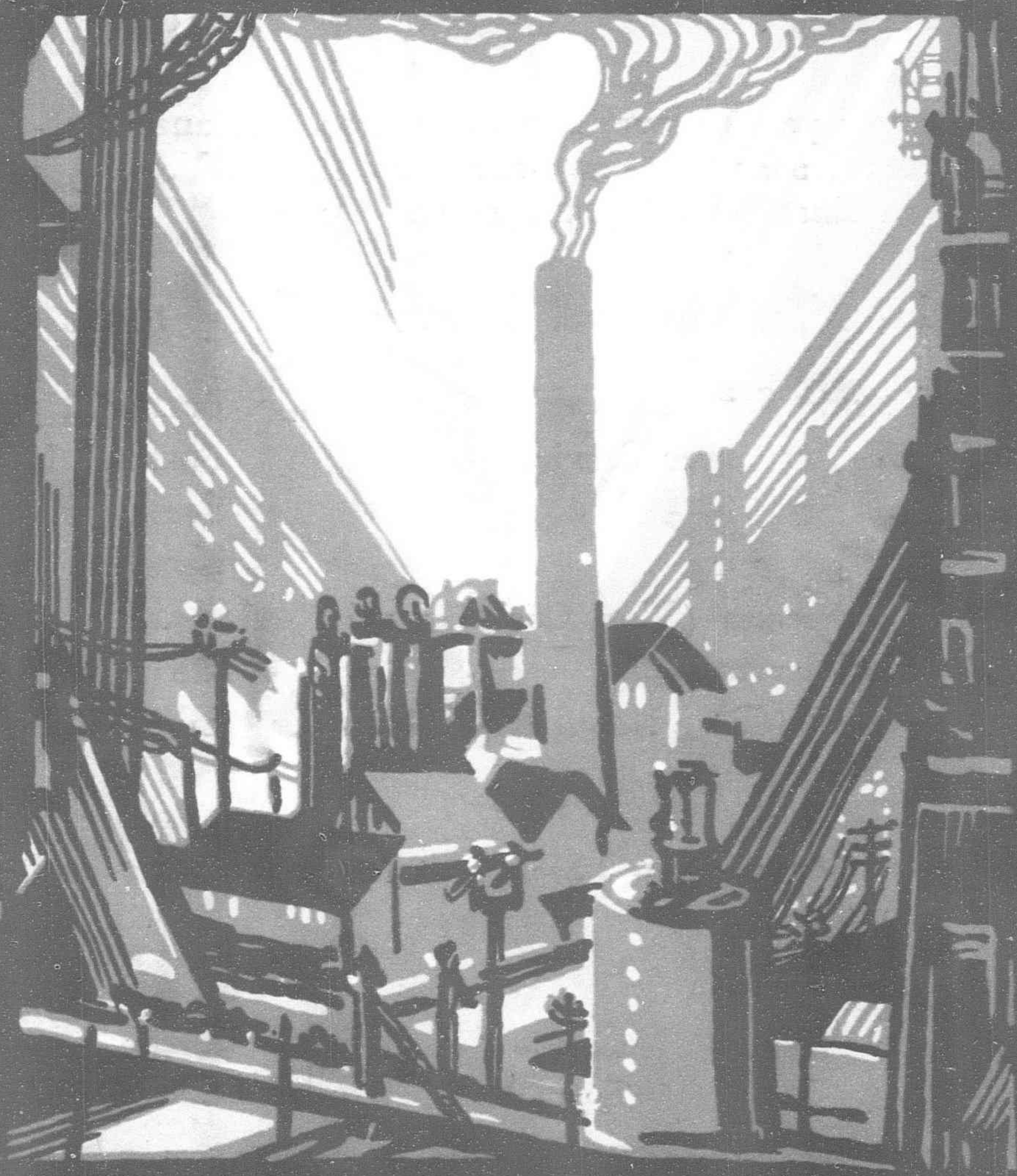


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上海黃浦灘念四號

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MUST AMERICA FIGHT JAPAN?

By GEORGE BRONSON REA

SINGAPORE'S FUTURE, A PUZZLE

Vol. XXX

MAY, 1934

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Must America Fight Japan?

An Analysis of American Policies in The Far East

By GEORGE BRONSON REA

Following is an address delivered by George Bronson Rea, before the students of Georgetown University, Washington, D.C., on March 7, 1934.

DO you ever stop to think what is behind all the talk of war between the United States and Japan? We hear it everywhere. From across the Pacific, the spokesmen for China shout that the United States *must* fight Japan; they remind us that we have so committed ourselves that we are now in honor obligated to go to war to uphold our treaties and doctrines. A group of propagandists whose only usefulness to China is to remind us of these commitments, croon away on their eternal theme song. From Europe, where the wish is father to the thought, comes a monotonous prophetic chant on the inevitability of such a war. From Washington, our statesmen iterate and reiterate policies, formulate and promulgate new doctrines, thunder denunciations, hurl anathemas and marshal world opinion against Japan, while our jingoes take up the refrain and swell the chorus: "We've got to fight; we've got to fight Japan!"

As Counsellor to the Government of Manchoutikuo, you naturally expect me to talk to you about that country, but I prefer to stand here to-night and address you as one American to another and analyze those policies and issues the rest of the world confidently expect will compel us to go to war to uphold. It is time we stopped playing the ostrich. There are grave issues forming in the Pacific and unless we walk warily, speak softly and carry the proverbial Rooseveltian persuader we may find ourselves in a position from which we can not recede without a fight.

The Secretary of State of the last administration laid down the doctrine that the United States could not recognize Manchoutikuo. He then invited the League of Nations to co-operate in enforcing it. Geneva jumped at the chance to link itself with the United States in a common policy that would so entangle and commit us that ultimately we would be compelled to join the League. But the Great Powers which dominate the League will never consent to this co-operation passing beyond the moral stage to where it calls for the application of sanctions and war. The Stimson Doctrine is purely American. If ever implemented and enforced, we will have to do it alone. We naively expected those Great Powers whose security we declined to underwrite to come to our assistance when our own vital interests and policies seemed imperilled. Of course, they accepted the Stimson Doctrine and we now find ourselves out on the end of a limb without the armaments to enforce respect for it. We walked into this trap with our eyes open and now, after thirty years of wobbling diplomacy we find ourselves squarely "on the spot." Europe eagerly anticipates the denouement in the Pacific. We are back again to 1920. The only two belligerent nations which emerged from the world war with profit were the United States and Japan. Could these two nations have been prodded into a war immediately afterward, these profits would have rolled back to where they came from, American commerce in the Pacific would have been destroyed, Japan bankrupted and set back for a generation and the trade and development of China would have been monopolized by

"Europe." We were on the toboggan headed for a war in the Pacific but the Washington Conference averted the catastrophe. Since then, we have gradually been manœuvred into the same perilous position. War between Japan and the United States would automatically solve the war-debt problem and the rest would follow.

It is time to ask the question: Must we fight Japan? Are we prepared? What could we gain from such a war? Do the policies of these two great nations conflict to a degree that we must now fight to impose our viewpoint? What are those policies? What do we want in the Far East? If we can answer this last question, perhaps we can then understand better just what Japan is after.

The Instinct of Self-Preservation

It is not difficult to explain Japan's policies. They are firmly rooted in the instinct of self-preservation; a determination to survive at all costs in the intense struggle for existence; to find an outlet for her rapidly mounting millions, an outlet she has already fought three victorious wars to obtain, but which the rest of the world would deny to her. In addition to this basic policy which influences her diplomacy and military strategy, Japan faces a menace in Asia that to her is very real and very imminent. Rightly or wrongly, Japan interprets American policy as denying to her the right to escape from these difficulties. She sees in every move of ours an attempt to block her expansion, holding her fast to treaties not binding on Soviet Russia or China. So until we have a better understanding of just what lies behind American aims and aspirations in Asia, it is difficult to analyze Japan's policies.

What then is our interest in the Far East? Is it commercial, educational, evangelical, political, or just plain emotional? For many years, our policy towards China was dictated by the Evangelical Missionary Boards and our Diplomatic representatives to that country selected for their special fitness to advance our missionary and educational activities. In proof of this, let us turn to the records.

Twelve years ago there appeared a book entitled "All in a Lifetime," written by Mr. Henry Morgenthau, father of the present Secretary of the Treasury. During the presidential campaign of 1912, Mr. Morgenthau senior, was Treasurer of the Democratic National Committee. When Mr. Wilson was elected, he rewarded Mr. Morgenthau by appointing him Ambassador to Turkey. Mr. Morgenthau declined the honor. Senator O'Gorman induced him to visit Washington and talk the matter over with the President. At that meeting, Mr. Wilson explained that the two most important diplomatic posts which demanded the greatest intellectual equipment in our representatives, were Turkey and China. Mr. Morgenthau then said "in that case he preferred the post at Peking, even though it was only a ministership." He explained that his co-religionists had become very sensitive over the impression that the only post in the diplomatic service to which a Jew could aspire was the one at Constantinople and they severely criticized Mr.

Oscar Strauss for having accepted it for three successive terms. Mr. Morgenthau added that he shared the feelings of his co-religionists and thought it unwise to confirm their impression.

Mr. Wilson angrily retorted that he had selected him for Turkey, because the only interest the American people had in that country was the Zionist movement in Palestine, and he had to have a Jew at Constantinople, whereas our chief interests in China are largely missionary, calling for a Christian and preferably a man of the evangelical type. In these words, Mr. Wilson explained how impossible it was to send a Jew as Minister to Peking where his principal duty would be to protect Christian missionaries. Mr. Morgenthau, a capable banker and business-man, the type that the job at Peking was crying loudly for at that time, was turned down because of his religion.

The sequel is told in the Intimate Papers of Colonel House. After touching on the Morgenthau incident, he reviews the difficulties encountered by President Wilson in finding a suitable envoy to fill the post at Peking. It seems that Secretary of State Bryan had very decided views of his own about this appointment. He held that as the New China movement was founded on Christianity, only an orthodox Christian could represent the American Government at Peking. Mr. Wilson finally offered the mission to Dr. Charles R. Elliott, president emeritus of Harvard University, and communicated to Colonel House that the Peking post had been filled. Meeting Secretary Bryan shortly afterwards, House informed him of the President's choice. Bryan was much distressed and said it was the poorest selection that could be made for the reason that Elliott was a Unitarian and did not believe in the divinity of Christ. He was somewhat reassured when House told him that Dr. Elliott would not accept until he had talked it over with his wife. Bryan then said, "I hope she won't go."

Colonel House then goes on to relate his experience in finding a suitable man for Peking. He describes his interviews with other aspirants for the job and his efforts to ascertain their attitude on religion. Here we see a banker and business-man, highly qualified for the post at Peking rejected because he was a Jew. One of the greatest intellectual giants the country has produced, was disqualified because he was a Unitarian! It only remained for a Catholic to apply for the job to complete the picture.

Why the Missions Can Dictate

These incidents reveal how firmly the major Protestant denominations dictated our China policy and how difficult it was for anyone not endorsed by their Mission Boards to be appointed to the post of American Minister to Peking. No Jew, no Unitarian, no Catholic need apply! I once discussed this with a prominent official of the Wilson administration, and he said, "Why not? They pay the freight and the Government has to protect them."

By this, he meant that our missionary stake in China was far in excess of our commercial investments and entitled to preferred treatment. He was right. Up to 1929, American investments in China totalled \$160,000,000 of which a little more than one half was missionary. Of the \$80,000,000 commercial stake, about one-half represented the investment of our major oil interests, leaving \$40,000,000 to cover all other activities. Since 1929, we have increased this stake \$55,000,000 by taking over the Shanghai Power Plant and the Shanghai Telephone system. We now have about \$230,000,000 invested in China. The British stake is estimated at \$1,750,000,000, the Japanese about \$1,400,000,000. At the time of the Nanking incident in 1927, I quoted these figures to one of the high officials of the Coolidge Administration and asked, "What would *we* do if we had \$1,500,000,000 invested in China?" The reply came quick and emphatic, "*We would fight to protect it.*" Obviously, we would not fight to protect the investments of our missionaries and oil companies. Nor would they expect the Nation to do it. Neither could we be expected to go to war to protect the \$40,000,000 balance of our investments. The best interests of our missionaries demanded that we do nothing that would arouse the hostility of the Chinese against the United States. These figures explain why our policies towards China were for so long a time shaped to protect and advance our major interest in that country and why, in nearly every crisis our Government subordinated our commercial interests to our more important uplift activities.

The success of this missionary and educational crusade hinges entirely on an uninterrupted flow of contributions and endowments.

Any incident that might arouse an anti-Chinese sentiment in this country and cut off or diminish this flow of money would automatically slow up the work. For this reason, the missionaries present only the bright side of the Chinese picture to the people of this country and oppose the merchants who clamor for armed protection when their lives and properties are imperilled by Chinese armies, bandits, pirates or anti-foreign mobs. Time and again, when American lives and properties were imperilled, certain missionary elements have brought pressure to bear on Washington to refrain from taking strong action. In 1927, at the height of the Nationalist movement, with Shanghai menaced by the same Communist armies responsible for the Nanking outrage, this element brought all its influence to bear on the President and Secretary of State to withdraw our troops and war-ships and evacuate all Americans, rather than incur the ill-will of the Nationalists by defending our treaty rights. Great Britain and France, menaced with the loss of their immense interests in the Yangtze Valley, asked us to co-operate with them in armed intervention, but our Government declined to act. Behind this policy, we see the Evangelical Churches influencing our Government to support their specific interests. Let us, therefore, keep this phase of our activities in mind while we turn to the commercial side and endeavor by an analysis of the trade returns to arrive at some clearer understanding of our objective in the Far East.

Meaning of the Open Door

The popular conception of our Far Eastern policy is that we must keep open the door of equal trade opportunity, and to assure us of that privilege, we insist upon maintaining the territorial integrity and administrative independence of what the Western world is pleased to call "The Republic of China." We finally succeeded in having this policy written into the Nine Power Treaty, thus making it binding upon the Eight other Signatories. Through a long-drawn-out Colonel Sellars propaganda on the wonderful possibilities of supplying the wants of the 500,000,000 people of China, we have been educated to believe that their trade is essential to our future prosperity, and we must go to war if the Open Door principle is violated. Let us look at the trade returns and judge for ourselves how far we are justified in fighting for our conception of the Open Door.

For the past thirteen years (1920-1932) our exports to China were valued at \$1,359,000,000, an average of \$100,000,000 a year. Of this, 40 per cent represents oil and tobacco, and with raw cotton added, a little over 50 per cent. We do not have to go to war with any nation to hold this part of our trade with China.

The Japanese have invested over \$500,000,000 in industrial enterprises in China, which creates a market exclusive of raw materials of at least 10 per cent a year for spare parts, extensions, repairs, new machinery, supplies and accessories. Japanese firms have purchased as high as \$45,000,000 a year of American materials for these enterprises. I am, however, taking the lowest figure, placing it at \$25,000,000. In the last three years we exported to China \$24,000,000 a year in raw cotton alone, and at least 75 per cent is consumed by the Japanese cotton mills in that country. My estimate is therefore rather under than over the actual figures. So, if 50 per cent of our export trade with China is in oil, tobacco and cotton and 25 per cent in what the Japanese buy for their own enterprises in that country, it leaves 25 per cent in sundries for which we have to compete with the rest of the world. Expressed in dollars and cents, the Open Door boils down to selling annually \$25,000,000 of American goods in China.

In addition, the Japanese purchase in this market another \$50,000,000 of raw and partly finished materials for export to their own country where they are manufactured into finished products and exported to China as Japanese goods. This brief analysis reveals that the Japanese sell as many American goods in China as we do ourselves.

How much profit do we make from this \$100,000,000 export trade? Let us put it at 10 per cent, say \$10,000,000. Now, on the other side of the ledger put the following: for many years we contributed roughly \$10,000,000 a year for missionary work alone, with perhaps another \$5,000,000 for colleges, hospitals, Y.M.C.A.'s, Rockefeller Institute and other welfare activities. For every dollar of profit from our trade with China, we handed back one and a half for charity. These philanthropic contributions are

now much less, perhaps one-half, but as our export trade has also fallen off, the proportion remains about the same.

I do not know what it costs the taxpayer to maintain the Asiatic Fleet, the Yangtze Patrol and the three regiments of marines and regular infantry in China to protect the lives and property of our citizens, but it will fall not short of \$25,000,000 a year. It may be argued that if these ships and regiments were not on foreign service, they would be on home duty, therefore it is unfair to charge their upkeep against our trade with China. It might also be contended in that case that our armed forces might be reduced accordingly with benefit to the taxpayer. Eliminating the Asiatic Fleet and the two regiments of marines, this leaves the Yangtze Patrol, the Regular Army Regiment in Tientsin and the Legation Guard whose maintenance becomes a direct charge against our China trade. Add to this, the cost of subsidizing the American mercantile marine in the Pacific, the expense attached to our Commerce Department, pile on the defaulted and repudiated loans and the unpaid bills for materials delivered to the Chinese Government, spread these items over a period of thirteen years and the total will not be less than \$6,000,000 a year. I will say nothing of Red Cross Famine and Flood Relief, or even the recent \$50,000,000 cotton and wheat credit, nor include the remitted Boxer Indemnity. I will not be far wrong when I assert that including the fleet and two extra regiments, the cost of protecting and advancing our trade with China is probably \$30,000,000 a year. I make bold to state that in thirteen years, the nation is out-of-pocket at least \$500,000,000 in its trade with China.

Another Item to be Added

But this is only half the story. There are some 60,000 Chinese legally residing in this country, and according to the American Commercial Attaché at Peking, they remit to China annually the sum of \$25,000,000. Spread over the thirteen years 1920-32, this means another \$300,000,000, or a total adverse balance of approximately \$800,000,000 during this period in our trade with China; the profits from eighty years of normal trading with that country. Yet in the face of these figures, you will find economists, trade promoters and publicists who will tell you that it is not the present trade with China that interests us. All this expense is merely an investment to get in on the ground floor, so that in years to come, when China has settled down and can buy our products, we will reap our reward. Is this hope justified? Let us look at the picture of China.

The root trouble with China is that it is overrun with personal armies, bandits, pirates and communists, all fighting each other and awaiting the opportunity to seize each other's territories and revenues. The armies of China are estimated at 2,500,000, with another 2,000,000 bandits and communists roaming the countryside. There are nearly 5,000,000 men in China with a gun in their hands preying on the people. In the last twelve years, more people have been killed by these armies than were killed during the World War and proportionately more property and wealth has been destroyed. Every cent that can be raised from revenues and taxes, forced loans, contributions and levies, from opium monopolies, transit hold-ups and through other illegal means, must be spent on the upkeep of these armies. Little or nothing is left for education, hospitals, public works, industrial development, railways, highways, flood or famine relief, or other urgent constructive schemes. Before a central government can consolidate its authority over the whole country, there must be built ten to twenty thousand miles of trunk railways, costing anywhere from a half to over a billion dollars gold. Where are these huge loans to come from? There was a time when they might have been raised in the international money market, but that day is past, never to return in the lifetime of the present generation.

Unless China can finance her own railway program, there is now no hope of establishing a government that can consolidate its rule over the whole country. Wars will follow wars, trade will diminish and the country will become more and more impoverished. The day may arrive when some war-lord will impose his rule by the sword over these 500,000,000 people, but as each province is conquered, it will require an army of occupation to hold it in subjection. As long as the Nine Power Treaty endures, carrying with it foreign recognition and financial support to one war-lord or political faction, there is no hope of disbanding the armies of China or of any great increase in the volume of trade.

Only by a reversal of the principle embraced in this Treaty, and the recognition of the rights of the various provinces to complete independence or autonomy, can any real and lasting unity be brought to China. Then, under some form of representative government, a new era may open for the long-suffering millions of Cathay. The point I wish to stress is that if our policies are based on the expectation of future trade rewards, we are going the wrong way about it. Adherence to the Nine Power Treaty perpetuating the present immoral and barbarous war-lord system merely invites further slaughter of the people and ruin of the country and can only delay indefinitely a return to normalcy, which, at its best, is grinding poverty.

Some of our manufacturers base their hope of a great future trade with China on the industrialization of that country. Chinese capitalists and government officials loudly advocate the establishment of modern industries with foreign loans and credits. Following the example of Moscow, the Nanking Government has drawn up its imposing Five Year Plan to transform an agricultural nation over night, as it were, into a modern industrial state. But the Chinese will never hazard their own money in these undertakings. If the Chinese in the United States can remit \$25,000,000 a year to China, the inference is that their profits must be in the neighborhood of \$100,000,000. If the Chinese in this country had faith in their own Government, they could readily finance its plans for rehabilitation and reconstruction with their own money. This the most volubly patriotic Chinese will not do. They expect the foreigner to advance the funds and then hand over the enterprises to their management. The Chinese understand perfectly well how difficult it will be to sell the products of these plants to their own impoverished people, and their unbounded enthusiasm for industrialism arises from dreams of huge profits to be made by exporting their goods and underselling the foreigner.

Transportation the Essential Need

The industrialization of China without an adequate system of modern transportation, simply means that the manufactured output will find its markets overseas in competition with the goods of the countries which furnished the capital. Aside from official or semi-official munitions plants and allied industries, there can be no great industrial advance in China. If conditions were now favorable, the industrialization of China would end our own commercial supremacy and hasten the collapse of our civilization.

We have the example of Japan before us, and must face the fact that this country is now one of the most formidable competitors to Western industry. The commercial menace of Japan is perhaps not so great for the United States, as any loss of trade due to her competition is fairly balanced by her purchases of raw and partly finished materials in this country. This compensation, however, would not apply to an industrialized China who can supply her own raw materials and with unlimited cheap man-power, swamp the markets of the world with lower-priced goods. I do not believe we will repeat in China our mistakes in Japan and other countries. The day is past when our capitalists will be permitted to erect branch plants in foreign countries and see these plants compete with our domestic output in other markets. We have learned our lesson.

So we come back to the question: What is our real objective in China? If we are interested solely in trade, we must find some formula that will facilitate the unification of China without further loss of life or destruction of property. This solution cannot be brought about without co-operating in friendly international intervention in the affairs of China along the lines recommended by the League Commission of Enquiry. But even this Commission admits that it is impossible to create a strong, central government in China without adequate means of communication to enable it to consolidate its rule. The problem therefore reduces itself to whether or not the League and the United States will advance the huge sums required to construct these new railways, and whether or not China would be willing to concede the necessary guarantees for supervising expenditure of the funds, surrender control over the management and operation of the lines and provide armed protection against roving war-lords and bandit chiefs. Without these ironclad guarantees, foreign capital will never take the risk. So once more, we come to a dead wall.

Can anything be done? I doubt it. Our State Department has made a fetish of the Nine Power Treaty and clings to it as the

corner stone of its Far Eastern diplomacy. We will not intervene ourselves in China; we will not co-operate with other Powers, nor will we permit any single power to act alone.

The deduction to be drawn from all this, is that American policy towards China is not clearly defined. It has been shown that we are more interested in giving away money than in making it and that any talk of going to war over the Open Door reduces itself to a declaration that we will fight to remain in business as an eleemosynary institution. China has become our pet charity. We will never go to war to convert the Chinese to Christianity. If we rule out uplift and trade, there is nothing left but some political objective which has no direct bearing on our own strategic security. We begin to sense that in some way the Nation is pledged to uphold the territorial integrity of China at all costs as well as guaranteeing Asiatic Russia against aggression. Have we extended our Monroe Doctrine to embrace the whole Pacific area?

While I can understand our policy for the preservation of China's integrity, I can find no justification for extending it to cover Asiatic Russia. Yet that also seems to have become a cardinal feature of our Asiatic policy. In October, 1917, the Allied Supreme War Council agreed to invite Japan to occupy Vladivostok and keep open the Trans-Siberian Railway and to compensate her services to the Allied cause with a slice of Siberian territory. President Wilson, however, opposed the plan, holding up the expedition for several months until his ideas for joint Allied intervention prevailed.

Without authorization of Congress or any appropriation to cover the expense and, against the advice of his highest military advisers, President Wilson dispatched an American Expeditionary Force to Siberia under sealed and secret instructions, for the purpose preventing Japan from gaining any advantage. General Graves, commander of this expedition, was entrusted with the most dangerous, explosive and delicate mission an American army officer has ever been called upon to carry out. At all times he sat on top of a powder magazine. Any fool doughboy might have thrown the proverbial match. Had Graves slipped, we might have become involved in a war in the Far East without the troops, transports or supplies to wage it to a successful finish. The consequences of a false step would have been tragic. We might even have lost the war on the Western Front. Yet Wilson took upon his shoulders the sole responsibility of courting this danger in order to thwart the plans of his War Associates and protect the interests of the Russian people.

Making Russia Safe for Bolshevism

No sober-minded American can read Mr. Newton D. Baker's Foreword to General Graves' book on "America's Siberian Adventure," without a feeling that there is little difference in being the subject of a military autocrat and the citizen of a free republic when it comes to being ordered out to the slaughter. Mr. Baker, in justifying the dispatch of an American army to Siberia without our boys knowing what they were expected to die for, says: "Even the soldiers of a Democracy cannot always understand the reasons back of strategic situations. Political and military reasons are worked out in cabinets and general staffs and soldiers obey orders. . . . And if it should turn out that there is wanting some detail of justification, from the nation's point of view, for the Siberian adventure, nevertheless, those who took part in it can have the satisfaction of knowing that the American force in Siberia bore itself humanely and bravely under the orders of a Commander who lived up to the high purpose which led their country to attempt to establish a stabilizing and helpful influence in remote wastes inhabited by a confused and pitiful but friendly people."

It is difficult to understand Wilson's solicitude for the interests of a people he sent an army to Siberia to protect against spoliation while he himself was later busily engaged in slicing off large chunks of European Russia in order to set up new states which served the two-fold purpose of giving expression to his principles of self-determination and building a *Cordon Sanitaire* to defend Western Europe against the spread of Bolshevism. Mr. Baker's explanation fails to convince. An American army was dispatched to Siberia for the sole purpose of blocking Japan and in so doing, "*made Asia safe for Communism.*"

Mr. Baker informs us that soldiers and general staffs are merely the instruments to carry out blindly the orders of cabinets composed of politicians. The record shows that our army was

sent to Siberia without authorization of Congress, without any appropriation for its maintenance and against the advice of our two chiefs of staffs responsible for the military conduct of the war. It is the first intimation the American people have received that the general staffs of the army and navy are not permitted any voice in the deliberation of policies they are expected to enforce. I ask you to ponder carefully over these words of the man who was our War Secretary under Wilson and then remember that the worst criticism that our press hurls at Japan and cites as proof that the nation is militaristic, is the fact that the Ministers of Army and Navy are Generals or Admirals in active service, responsible for their acts to the Emperor alone. In view of Mr. Baker's candid admission of how our own affairs are conducted, I am inclined to believe that it would be highly beneficial if a similar system were adopted in our own government before some pacifist cabinet takes on its own shoulders the responsibility of committing the nation to policies that our army and navy could not enforce and where failure to do so might bring disaster. Is it fair to ask that the people of the United States be informed whether or not similar dangerous policies have been laid down by subsequent cabinets without consulting the general staff of the army or navy? Sufficient evidence exists that such policies have been formulated and proclaimed. If the revelations in "More Washington Merry Go Round" concerning Admiral Pratt's protest to President Hoover against Mr. Stimson's diplomacy is true to fact, the Nation is once more facing a dangerous situation through laying down policies that our Navy in its present enfeebled condition cannot uphold or enforce.

The sequel to our Siberian adventure is seen in the recent negotiations for the recognition of Soviet Russia. Moscow has contested our claims for repudiated loans, and property confiscated by advancing a counter claim for damages arising out of the dispatch of the American Expeditionary Force to Siberia. After satisfying himself by reference to documents on file in the State Department that the United States had saved Siberia from being annexed by Japan, Litvinoff withdrew the Soviet counter-claim and wiped that part of the slate clean. The inference would seem to be that in addition to preserving China intact, we have also extended our protective guarantee to Soviet Russia. All our protestations of friendship for Japan cannot erase these facts from the record.

The Fundamental Problem of Asia

While you keep these aspects of our policies before you, let us get down to the fundamental problem of Asia.

The population of Japan Proper is 70,000,000, increasing at the rate of a million a year. There are 90,000,000 people in the Japanese Empire. In twenty years, during a life-time of the present generation, there will be 120,000,000 Japanese.

Turn to China. Here we see a population of 500,000,000 practicing a religion, based on ancestor worship, which demands as many sons as possible to perpetuate the cult. They keep no vital statistics. But let us assume they are doubling their numbers in one hundred years. In the next two decades there will be another 100,000,000 Chinese.

Behind China lies Russia, with a population of 170,000,000, doubling its numbers in forty-five years. The latest reports from Moscow show an annual increase of 3,000,000. At this rate, in twenty years, there will be 60 to 80,000,000 more Slavs.

These three countries must therefore find room for 200,000,000 more people in the next two decades. Where are all these millions to go? How will they exist? Our scientists and philosophers may say that Nature will take care of this increase. I have three shelves of books in my library on population, immigration and race movements and am familiar with all the arguments pro and con on this subject, but I merely invite attention to the fact that while we are discussing it, the peoples of Asia are increasing. It is now too late to theorize. Within the next two decades the issue of the races will become acute. These Asiatics will continue to multiply. What is to become of them? They cannot come this way. Canada, Australia, New Zealand, British South Africa and other countries have followed our lead and excluded them. South America offers an outlet for a few millions, but even there, we may expect the enactment of exclusion laws when immigration reaches a certain figure. These people must therefore remain in their natural habitat, in Asia.

The struggle for existence between these three racial groups has already started. Japan, with her teeming millions, has forced the issue. She has broken through the treaty barriers erected by the West to bottle her up and announces in unmistakable language her determination to fight for her right to exist. Keep this picture in mind while I paint in a background that will help you to understand why Japan now asserts her rights and challenges the world to come and crucify her.

You have heard a great deal about treaties in the last two years, but there is one treaty whose existence has never been referred to in the controversy over Manchuria. Let us go back to 1895. In that year, little Japan hurled herself against the Chinese Giant and in a short, swift, brilliant campaign exposed to the world the utter inefficiency of the Chinese army. China was forced to sue for peace at any price. In the treaty negotiated at Shimonoseki, China ceded to Japan in perpetuity and in full sovereignty the southern part of the Province of Fengtien, known as South Manchuria. As far as China was concerned, this territory now belonged to Japan. But before the ink was dry on the treaty, Russia, France and Germany advised Japan that she must restore this territory to China in order to preserve the future peace of the Far East. Japan could not fight the three strongest powers of Europe and was forced under duress to surrender the legitimate fruits of her victory.

Story of A Secret Treaty

In May, 1896, Li Hung-chang during a visit to Moscow, entered into a secret military alliance with Russia aimed at Japan. The duration of the Treaty was fifteen years. To give effect to this alliance and facilitate the transport of the Russian armies through the territory of China to the menaced points on the frontier, and for their subsistence, China ceded to Russia the right to construct a railway across her northern Manchurian provinces in the direction of Vladivostok. China deliberately surrendered her territory in order that the armies of the Czar could place themselves in a strong strategic position to crush Japan. That is how Russia entered Manchuria, and that was the reason for building the Chinese Eastern Railway, a purely military line designed to carry out the object of the alliance. The existence of this alliance was maintained a profound secret. The Commercial Convention for the construction and operation of the Railway signed in September of the same year was, however, given full publicity. The Secret Treaty of Alliance came into operation on the signing of the Commercial Convention. It is impossible to dissociate the one from the other. The Secret Treaty fixes the legal status of the railway. From September, 1896, China became the full ally of Russia in preparation for a war of revenge upon Japan.

Two years later, in 1898, a further concession was granted by China to Russia to build what is known as the South Manchuria Railway. At the same time, China leased to Russia the Liaotung Peninsula for a term of twenty-five years, thus providing her with a warm water outlet. Russia immediately converted Port Arthur into an impregnable fortress and naval base, and was then ready to force the issue with Japan. China had faithfully discharged her end of the bargain.

What followed is history. Japan staked her existence against the most formidable military machine of Europe. She lost 200,000 men and nearly bankrupted herself. The cost of the war to Japan was over Y.2,000,000,000. Japan sent her delegates to Portsmouth and signed the peace with Russia, but in lieu of a cash indemnity, had to accept the reversion of Russia's rights to the broken-down South Manchuria Railway and the unexpired term of the lease to the Liaotung Peninsula. So well had the existence of the secret treaty been guarded, that the war was fought and peace signed without the world ever suspecting that China was the full ally of Russia. China emerged from the war as the innocent and injured victim with world sympathy aroused in her behalf. Even the victorious Japanese apologized to China for having fought Russia on her soil.

It was not until 1911 that any inkling of the truth leaked out. The Chinese Minister to London, the son of Li Hung-chang, defending his father's diplomacy, wrote an article for one of the London newspapers and revealed the facts surrounding the existence of the secret treaty and published its full text. As the article was signed "An Admirer of Li Hung-chang," it passed unnoticed; just another newspaper sensation. A few years later, M. Gerrard, a former French Minister to China, wrote his memoirs, and referred

to the existence of this treaty. This also was unofficial. Mr. E. J. Dillon in his book, entitled "The Collapse of Russia," referred to the treaty, but this was also "off record." At the Paris Peace Conference, a Russian Delegation headed by Sazanoff, representing the old Czarist régime, filed with the Big Four a dossier of documents bearing on Russian interests in the Far East. Among them was this treaty, but as the delegation was there unofficially, it was excluded from the records. A copy of that treaty came into my possession at Paris. When I read it, and became assured of its authenticity, I realized that here was the key to the Chinese Puzzle, which clarified and explained every subsequent move on the Far Eastern chessboard.

Just A "Telegraphic Summary"

Immediately following the Peace Conference, the Memoirs of Count Witte appeared in print, and in them he described all the circumstances leading up to the signing of the treaty. But this was also unofficial. From many sources the evidence had piled up that such a treaty had existed, and, when at the Washington Conference, Secretary Hughes called upon the delegates to file copies of all treaties, secret or otherwise, bearing upon China, the Chinese Delegation was at last faced with the necessity of breaking the silence of years. So we find that on November 21, 1921, Dr. Wellington Koo, one of the Chinese Delegates, handed to the Chairman the "telegraphic summary" of a treaty of alliance between China and Russia, dated May, 1896, promising to file the full text as soon as it was received. A comparison of the summary with the full text will reveal how carefully the words were deleted which concealed the strategic and sinister character of the Chinese Eastern Railway and transformed it into an innocent commercial enterprise.

When Secretary Hughes read this summary in open conference, it constituted the first official admission that the treaty had existed, legal evidence which threw upon China the responsibility for the Russo-Japanese War and entitled Japan to the indemnity she was cheated out of at Portsmouth. The evidence which justified the Anglo-Japanese Alliance and Japan's position in Manchuria went over the heads of the assembled delegates. They were all looking out the window admiring the scenery along the Potomac. Even the Japanese Delegates refrained from comment as this evidence went into the record. Had the Chief Japanese Delegate arose at that juncture and demanded a reopening of the whole Manchuria question based on this confession, it would have broken up the Conference. That the Japanese did not stand on their legal rights at that moment, requires an explanation.

Japan accepted the invitation to attend the Conference on the understanding that the question of Manchuria would not come up for discussion and it was clearly understood that these matters were to be adjusted between China and Japan without the intervention of any third party. The Japanese desired to advance the work of the conference and usher in a new era in the Pacific, placing the interests of peace ahead of their quarrel with China. Had the Japanese called for a showdown, the Nine Power Treaty could not have been signed.

With these facts before us, let us go back to 1898 when John Hay invited the Powers to subscribe to his Open Door Doctrine. The only government which hastened to accept his principles without reservations, was that of Japan. That doctrine was then stretched to guarantee the territorial integrity and administrative independence of China. Yet at that very time, the beneficiary of Hay's diplomacy was the secret ally of Russia and had handed over her territory in order that the Russian armies could more easily get into position to vanquish Japan. Japan's acceptance of Hay's Doctrine bound her to respect the territorial integrity of China at the very moment when China and Russia were sharpening their swords in preparation for her undoing.

Had John Hay known of the existence of this secret treaty, had he even the faintest suspicion that it existed, would he have invited Japan to subscribe to his doctrine? Had Theodore Roosevelt known of the existence of this secret treaty, would he have invited Japan to Portsmouth and used his influence to have her surrender her claim to a cash indemnity? There is only one answer. No honorable American statesman or diplomat would have taken advantage of Japan under such conditions. John Hay was made the dupe of Sino-Russian secret diplomacy and led into pronouncing a political doctrine which strengthened their

position as against Japan. Since then, by a continuous propaganda, the United States has been committed the point where we are now expected by China to uphold our policies by force. It is clear to any intelligent American that our statesmen would never have adhered to a doctrine that might easily have led us into war to uphold it, had they been in possession of the facts revealed for the first time at the Washington Conference. The wonder of it all is, that no one at that Conference had the courage to stand up and defend Japan.

This can be explained only by the fact that the main object of the Conference was to bring about the cancellation of the Anglo-Japanese Alliance, limit Japan's power of offense and assure the signing of treaties that would safeguard our Insular possessions in the Pacific and enable China to set her house in order. Japan was on trial. It was not the duty of the Prosecution to weaken its own case. It was squarely up to Japan to defend herself and when she failed to do so, the way was cleared for the signing of those triumphs of American diplomacy, the Four and Nine Power Treaties. The principles underlying the Open Door Doctrine were incorporated into the law of nations because the diplomats of Japan subordinated the interests of their country to a sincere desire for peace, co-operation and understanding with the United States.

Another Forgotten Treaty

I might mention another treaty which has a most important bearing on the status of Manchoutikuo, taking precedence in international law over all other treaties. I refer to what are known as the Abdication Agreements solemnly entered into between the Republic of China and the Manchu Emperor, the Imperial Clan, the Princes and the Bannermen, which became the Fundamental Law of a Republic which immediately proceeded callously to violate their every provision. We may believe that our subsequent treaties with other nations to respect the territorial integrity and administrative independence of the Republic of China has become an inviolable principle of international law, but they can not bind the betrayed Manchus and people of Manchuria to respect their provisions. Their rights in law transcend any treaties entered into between other Powers and the Republic of China. Whatever they may do to regain their lost rights is their own concern. The Stimson Doctrine denies to these people any redress and endorses the very principle it condemns. After disarming the Bannermen the Chinese Republic despoiled them of their lands, their homes and their wealth, it drove their Emperor out of his sanctuary, desecrated the Imperial tombs, repudiated the subsidies agreed upon, and in general subjected them to every conceivable indignity and hardship. They had no legal redress. Only by force could they regain their rights. To deny to them the right to employ this force, is to condone and uphold the despoiler. So before we condemn the people of Manchoukuo for asserting their independence; before we too hastily judge Japan for violating the Nine Power Treaty, let us remember that other broken treaty, which justifies what they have done to redress one of the greatest wrongs in history.

The picture is not complete, however, without a brief reference to the outbreak of the Great War, the siege and capture of Tsingtao by the Japanese forces; the presentation of the Twenty One Demands and the treaties signed as the outcome of these demands, one of which extended Japan's rights to the South Manchuria Railway and the Liaotung Peninsula to ninety-nine years and the other by which Japan succeeded to the rights of Germany in Shantung. Japan did not want Shantung. She promised to restore it to China but desired to do it in her own way and use it as a trading card to consolidate her rights in Manchuria obtained under the 1915 treaty, which China immediately declared invalid because, as she alleged, it was extracted under duress. China would not face Japan alone in these negotiations and threw herself into the arms of the United States for protection.

When at last, through the pressure of American diplomacy, Japan evacuated Shantung, all she had to show for her three victorious wars was her treaty rights and investments in Manchuria. After the Russo-Japanese War, American diplomacy brought pressure upon Japan to compel her to sell the South Manchuria Railway to Harriman, and when this failed, we obtained from China the concession to build the parallel Chinchow-Aigun line in order to use it as a level to force Japan to sell out. When this fell through, Secretary Knox then proposed internationalization of the Manchurian Railways. When this also failed, we placed on

record that we retained all our rights in the Chinchow Aigun concession. Then, after the Great War, we again tried to force Japan to pool her Manchurian lines in a new international financial consortium, but could not influence her to abandon her basic rights. At every turn, Japan encountered American opposition, and receded before us step by step until there was nothing left but her investments in Manchuria. With the League Covenant, the Nine Power Treaty and the Peace Pacts, China's position seemed impregnable and under cover of their protective guarantees, she devised a program to undermine and destroy these investments as the first step in a campaign to force Japan out of Manchuria. The commercial treaty between the two countries had expired and China had informed Japan that no new treaty could be negotiated until she withdrew her troops from Manchuria and evacuated Liaotung. The issue was therefore clear cut.

Brief Records of History

Let us now piece together the pictures in this historical film. We see Japan in 1895 bludgeoned out of the legitimate fruits of her victory over China by the three strongest military Powers of Europe; during the next year China surrendered Manchuria to Russia under the terms of a secret alliance aimed at Japan; in 1905, after a victorious war with Russia, Japan was flim-flammed at Portsmouth out of a legitimate cash indemnity by the suppression of evidence concerning the existence of this alliance. Immediately afterwards, American diplomacy endeavored to deprive Japan of the paltry fruits of her victory by obtaining parallel railway concessions from China and then proposing to the Powers, internationalization of all Manchurian railways; in 1915, at the time of the Twenty One Demands, the American Government placed on record that it could not recognize any agreement that might be entered into between China and Japan which conflicted with its treaty rights and the rights of American citizens in China; in 1918, President Wilson against the advice of his highest military advisers, dispatched an American Army to Siberia in order to keep Japan from gaining any advantage from an intervention the other Powers were originally willing Japan should undertake for the common cause; at the Paris Peace Conference, President Wilson passed his resolution for incorporating the Monroe Doctrine in the Covenant of the League after it received a bare majority of the votes of the Committee of Thirteen, but when the Japanese resolution for the recognition of the principle of Racial Equality passed the same Committee by a still greater majority, Wilson reversed his ruling and held out for unanimity; in the negotiations leading up to the formation of the new Four Power Consortium, American diplomacy once more endeavored to pool Japan's Manchurian railway rights and other concessions in this new international combination; in 1921, at Washington, Japan was compelled to restore Shantung to China; the Anglo-Japanese Alliance was cancelled, leaving Russia full liberty to do as she pleased in Asia; through the Naval Treaty, Japan's power of offense was destroyed and the Nine Power Treaty legalized China's subsequent anti-foreign agitations and protected her against retaliation or punishment; the Kellogg Pact of 1929, presented China with a charter to wage war within the treaties and the League Covenant by means of boycotts and severance of economic relations and to appeal to the Powers for help if any nation defended its interests by force. At the end of the reel, we see Japan practically stripped of the gains of her three wars, caught and held fast in a treaty trap, while China, with the whole world looking on in sympathy, was busily engaged in destroying her investments in Manchuria preparatory to driving her out of Liaotung.

The people of the United States and Europe have forgotten the Sino-Japanese and Russo-Japanese wars. But the Generals in command of the Japanese armies and the Admirals of her fleets received their baptism of fire in these struggles. The soil of Manchuria is watered with the blood of their comrades. Their graves and shrines commemorating their deeds dot the landscape from Port Arthur to Tiehliang. Their industrialists have invested \$1,500,000,000 in developing the country, transforming a bandit-infested wilderness into one of the most prosperous parts of Asia. Japan is still paying for the war that China forced upon her. To date, the Russo-Japanese war has cost Japan about Y.8,000,000,000. When to this is added, her direct investments, her stake in Manchuria is over Y.10,000,000,000. The world has heard no whimper out of Japan. Each year the interest on her domestic and external

war-debt is paid promptly on due dates. She has a good legal claim against China for an indemnity that would reimburse her for this expense, but has never presented or pressed it. She realizes that her legal case is hopeless, and has solved the problem in her own way. She has freed the Manchurians from the yoke of their merciless bandit-overlords, assisted them to set up their own government and recognized their independence.

The Part of the Militarists

There is a limit beyond which no self-respecting army will go, and if the world is seeking for an explanation of what happened in Mukden on the night of September 18, 1931, we have before us in these series of pictures the reason why the Japanese army acted in self-defense. For over ten years the Liberals of Japan had led the Empire along the paths of peace, surrendering little by little its security until there was nothing left but their economic rights and investments in Manchuria. Every gain the Army and Navy had obtained in three major wars had been wrested from them by diplomacy and they now saw the last remaining rewards of their many sacrifices slipping away under cover of treaties which bound them hand and foot from making a move to defend their rights. The Chinese were jubilantly and arrogantly pressing their advantage to the limit, declaring openly that their armies would chase the Japanese into the sea. Incident followed incident in rapid succession. The wonder is that the explosion did not happen long before. The little force of 11,000 Japanese Railway Guards in Manchuria in sheer desperation struck back in self-defense on the night of September 18, 1931, and in two days dispersed the armies of the Chinese war-lord and swept his corrupt government into the discard. The Japanese Army at home then imposed its will on the Government and assumed direction of its policies. All the outside world could see or understand was that Japan had turned militarist. World opinion condemned her as the aggressor, accused her of imperialism and of carrying into execution a long cherished plan to conquer and impose her rule over Asia.

Yet, under similar conditions, the same thing might happen in our own country. If the day should ever arrive when a pacifist administration and congress should surrender the vital strategic security of the Nation and expose it to invasion and subjugation, the fighting men of this country would arise in their wrath and impose their rule on the government of these United States. Fortunately, for us, we have no immediate enemy just across our borders. But, if on the other shores of the Caribbean, there existed two potentially powerful nations who outnumbered us ten to one in population and our government refused to appropriate the funds to defend the Nation against this menace, the people would sweep it out of power.

Now let us fill in the final reel to this film with a few close-ups. As we watch the unfolding of the picture in Asia let us keep in mind our past interest in the welfare of the Russian people and our armed intervention for the protection of their interests; recall the significant feature of our recent recognition of a Government which signifies "No God, No Property Rights and No Home" and its sequel, the establishment of a new official American bank in Washington and a ten million loan to Russia to buy our goods and enable her to push forward her military preparations in Siberia. Let us flash back to our cotton and wheat loan to China interpreted by the Chinese as a gift to strengthen their resistance against Japan; another flash showing the erection of an American aircraft factory in China to build bombing planes for its army and a training field with American ex-flying officers teaching the Chinese to become pilots. Get the picture of an American aviation company in partnership with the Chinese Government to operate commercial air lines, among which is the coast route from Shanghai to Canton. Stop right here and get the significance of this line. Japan's national defense plan must necessarily be based on her ability to close the Formosa Channel and the gaps between the Loochoo Islands with her submarines, mine fields, air fleets, etc. Against all Western Powers her position is invulnerable and she accepted the 3-5 ratio because of this advantage. The only weak spot in her armor is the possibility that a Chinese or foreign air force operating out of Fukien, might neutralize this strategic advantage and by keeping open the Formosa Channel, expose Japan itself to attack. If American aviation interests are now co-operating with the Chinese authorities to build landing fields and operate air lines along the Fukien Coast, we must not be

surprised if Japan becomes more and more suspicious of an open door commercial contract that conceals such a serious menace to her vital strategic security.

Sinister Signs for Nippon

Look at the other close-up of a similar American factory going up in Russia and the sale to that country of a thousand or more Sikorsky engines for bombers; flash a picture of France suddenly raising her flag over a few coral islets in the middle of the South China Sea, useful only as submarine bases; another flash of a group of British Admirals holding a council of war at Singapore; keep in mind the agitation in this country to have Japan surrender her Mandate over the Pacific Islands when her withdrawal from the League becomes effective; recall Litvinoff's hurried visit to Rome after his conferences with President Roosevelt and Mussolini's open talk about war, supplemented by Herriot's broadcast to the same effect and the series of Russian challenges to Japan which immediately followed American recognition. Fit all these pictures together and we will find they dovetail into the main film and create the impression that there does exist a set program to encircle Japan and coerce her into accepting the Stimson Doctrine. It is now too late to say that all this merely signifies moral disapproval of her actions. The League has endorsed and made the Stimson Doctrine its own and loses no opportunity to remind us that it is still in existence. Any two or three of these facts may be only a coincidence but a whole chain of events pointing to one thing makes it a certainty. We may cling to the delusion that our diplomacy carries no menace to any nation. We may attempt to shift responsibility on to the shoulders of the munitions makers of the world and brand them in Congress as "international criminals."

Senator Borah declared two days ago that "no sane, thoughtful person with a healthy mind would for one moment entertain the view that the recognition of Russia by the United States contained the slightest implication of an ulterior motive against Japan." This is unquestionably true, but the cold, hard facts remain. We may not see the implication of these facts but it is there nevertheless. No arguments, denials or excuses can erase them from the record. By applying the same logic that we would ourselves apply to events in Europe, other people arrive at the inescapable conclusion and conviction that this country is preparing for war with Japan. If Japan is now suspicious of our protestations of friendship and her militarists single us out for denunciation, who is to blame? Can we visualize the end of the film?

I have tried to outline the high points of our policies as they have found expression under successive administrations. We know that the policies of Japan are centered on finding a solution to her pressing population problem, of finding work, food and the necessities of life for a million new children a year. Japan will never force a war on the United States or any other Western nation in order to find an outlet for her increasing millions. There is room enough in Asia. Three times she has fought victorious wars to assure herself of this outlet and each time has been stripped by foreign diplomacy of the fruits of her victories. Desperate, with her back to the wall, she now grimly faces the world determined to go down fighting for her right to exist.

The Problem America Faces

Whether or not the world is to plunge into the horrors of another war, depends largely on how far the United States is prepared to go in the enforcement of its policies. If we build a ring fence around Japan and say to her that she cannot go into Manchuria, we must make up our minds that some day we must fight Japan. For that is the logical end of our policies and our diplomacy. I see no good reason why the young manhood of America should go to war in the Pacific with Japan in order to defend the interests of 500,000,000 people who will not fight for themselves and whose secret diplomacy has already caused one disastrous war and is now directed towards making us the dupe in another one. Neither do I see the sense in policies that would involve us in a war in order to assist 170,000,000 Slavs impose their Communist rule over Asia. If there was one vital interest of the United States at stake; if I thought we could even extract some material advantage from such a war, I might be sordid enough to say let us fight and have it over with. But there is absolutely nothing for us to gain from a war with Japan. If we win, we lose.

So I come back to where I started. If we knew for certain just what our own aims and aspirations are in the Orient, it might be easier to define and explain Japan's policies. I do know, however, that Japan does not want to fight the United States. Her rulers would make any sacrifice compatible with honor and dignity to be assured of our friendship and good-will. The menace to her existence comes from the other direction. We have no right to question whether or not this fear is justified. Every nation adopts its own measures for defense and reserves to itself the right to apply these measures in time to protect itself.

What then is to be the end of this conflict of policies? Our country is on the threshold of a New Era. We stand at the parting of the ways in more respects than one. We must either revise our Far Eastern policies and find some formula that will enable us to retire with dignity and honor from our position, or prepare to face the issues our sentimental diplomacy has forced upon us.

Can we fight Japan? I do not know how well prepared our Army and Navy is to enforce our policies. I can only hazard a guess based on our previous experience in these matters and on what more expert minds have conveyed to us. Under the present naval treaty, a war between Japan and the United States is almost a physical impossibility. All authorities on sea-power admit that it would require a navy three times larger than Japan's (with suitable bases) to assume the offensive. At the present moment, this means that it would take the combined American, British and perhaps part of the French fleet to carry the war into Japan's home waters. Even with her present submarine equipment, Japan could close the Yellow and Japan Seas, and defy the combined navies of the world to come and fight her. Obviously, neither Britain or France would leave their coasts undefended at this crisis in world affairs, and dispatch their fleets to Asiatic waters to take part in a war, in which, if they were only partially successful, might well result in their own downfall at home. This means, if it means anything at all, that if we are to enforce our policies and make the Stimson Doctrine stick, we will have to do it alone.

Our present naval program merely means we are building up to our treaty quota. To seriously think of enforcing our policies, we would then have to double the size of our navy and trust to the hazard of war to convince Japan that we are right in our viewpoint. Will the American people incur this expense and make this sacrifice? Is the game worth the candle? Can we stop a nation of 90,000,000 people on the other side of the world from expanding? Europe could not stop the United States from becoming great and powerful and the United States cannot stop Japan, unless the whole world joins in and tears her to pieces the same as we all did to Germany. In this case, we would probably again waive our right to an indemnity and shoulder the cost of the war for our associates. We Americans are like that.

The Lesson Japan Learned

Stop a moment right here and look at another picture. Eighty years ago, in 1853, Commodore Perry steamed his squadron of "Black Ships" into the forbidden waters of Tokyo Bay and demanded the opening of Nippon's ports for American trade. At the muzzle of the gun we forced Japan out of her seclusion of centuries in order that we could do business with her. We won. But Japan learned well the lesson we taught her. Now that she has perfected herself in the arts and industries of the West, adopted our military and naval strategy and learned the secrets of our diplomacy, are we going to send our fleets and air-squadrons to blow her back into isolation?

There is one thing we can and must do. Nothing can stop the rapid increase of the peoples of Asia. The mounting pressure in Japan must find an outlet. It will follow the immutable law of nature and break through at the weakest point. If we try to plug the outlet into Asia and then go to sleep and refuse to build up an Army and Navy, that pressure will break through in this direction. If we are wise, we will lose no time in building up a navy and air force, in fortifying the Canal, Hawaii and the Pacific Coast. We can then sit tight, prepared to defend our own shores.

If, however, we are to go outside our sphere to lay down doctrines and enforce our policies in other parts of the world, let us at least carry a Big Stick. We cannot always stand on a pedestal with a halo around our head, shake our finger at other peoples, call them names, tell them they are unfit to be associated with and that we cannot recognize what they have done until they repent and come to us for absolution. Some day, some one will get mad and throw a brick at us. We will then have to come down off our pedestal and fight.

In conclusion, we can compound amicably our difficulties with Japan and pave the way for negotiating a new naval treaty on a reduced tonnage ratio and transform the Pacific into a highway of peace and understanding, or, we can insist upon respect for our point of view and build up the mightiest navy in the world to enforce it. This is the issue of the Pacific which confronts the Nation. One road leads to peace and the other to war.

Can we arbitrate this issue? Senator Borah has enunciated the principle that anything can be arbitrated except the Panama Canal. The reason is obvious. The Canal is the nerve center of our national defense system and we would go to war at the drop of the hat to hold it. Japan has also laid down the principle that anything can be arbitrated except Manchuria which she also holds as vital to her national defense. Let me tell you a story. In September, 1921, when the Woods-Forbes Mission was returning from the Philippines, it remained some days in Tokyo. While there, General Leonard Wood held a round-table conference with the Japanese army and navy chiefs in which both sides laid down their irreducible minimum for peace. Wood very frankly told the Japanese that if they continued to fortify the Bonins, the Loochoos and the Pescadores to the point where at any time it would interfere with or stop American commerce with the mainland, the United States would go to war. Baron General Tanaka, spokesman for the Japanese, told Wood just as frankly and emphatically that if anyone interfered with them in Manchuria, Japan would fight. Japan will not arbitrate Manchuria and will fight before she surrenders her hard won rights in a territory she holds as vital to her security as the United States does the Panama Canal. Our refusal to recognize what Japan has done in these regions therefore constitutes a direct challenge and any attempt to implement and enforce the Stimson Doctrine must inevitably lead to hostilities. Are we ready for the showdown? If it comes, even through a war between Japan and Russia, will we be drawn into it? Will the other Powers come to our aid or will we have to face it alone? Remember, we would not come to the aid of France. Britain dares not send her fleet away from her home waters. We therefore stand alone.

Russia Looks for Aid to U. S.

The only power capable of challenging Japan's influence in Manchoutikuo is Russia. Does our recognition of Moscow and our agreement to extend vast credit for the purchase of our materials mean that as a last resort we have entered into a gentleman's agreement with Communism to coerce Japan into recognizing a doctrine the League and the United States are too feeble to enforce? The sudden change of front on the part of Moscow, its proclaimed desire to reshape its foreign policies and collaborate with the League to enforce peace, its bellicose utterances and challenges and its feverish preparations for war, would seem to indicate that the Communist Leaders interpret our recognition as tantamount to an alliance and, although this may not take the form of actual armed co-operation, it does mean unlimited financial support. European opinion also places this construction on our recognition of Russia. Are we "on the spot?"

A new campaign has been launched to get us to enter the League through the back door of the World Court. Whatever is done to save the League must be done this year. Once in, where we will have to assume our share of the responsibility, we can depend upon it that to preserve its own usefulness and existence, the League will lose no time in enforcing the Stimson Doctrine by applying sanctions against Japan. Sanctions mean war and in the present situation of European politics and armaments, we will not only fight but pay for that war.

The picture I have presented is not a pleasant one. There is, however, another brighter side which indicates that this Administration is endeavoring to avoid the issue forced upon it by its predecessor. The strategic key to our position in the Far East is the Philippines. In the event of war, Japan would occupy them overnight and it would require three or four years to retake them. President Roosevelt's Message to Congress on Philippine Independence may be simply the carrying out of the Democratic Party Pledge, on the other hand, it may also have its military significance, conveying an assurance to Japan that despite all signs to the contrary, the United States is not seeking trouble by implementing or enforcing the legacy willed to it by a former Administration. If President Roosevelt and his shrewd far-sighted advisers can find a way to repudiate the principles laid

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Singapore's Future, a Puzzle

Value of Britain's New Far Eastern Base Rather Speculative, as Naval Critic Sees Prospective Situation

By HECTOR C. BYWATER

The elaborate construction of the Singapore naval base has long been a subject of speculative discussion among those interested in the Far Eastern problems. The Singapore base has special significance in view of the fact that it has even been hinted that Britain has managed to pull the wires in causing the Netherlands to put up a stiff front against Japan in the commercial war, with the tacit influence of Singapore brought upon the practically defenseless Dutch East Indies. This may be mere talk, but what the noted naval critic, Hector C. Bywater, has to say of this British naval stronghold in this part of the world will prove of timely interest. The following article is taken from the "New York Times."

* * *

At irregular intervals since 1921 Singapore has bobbed up as a front page news feature. Recently it attained to the dignity of streamer headlines and leaded type, because four British admirals, representing the naval might of the empire in Pacific and East Indian waters, met on board a British cruiser in Singapore roadstead to discuss matters of imperial defense.

Twelve years ago it would have been reasonable enough to lay elaborate plans for the security of Britain's vast possessions in and adjacent to the Pacific. To-day such plans may be drafted on paper, but they cannot be put into execution, for the simple reason that the requisite means are not available. Idealism and sentimentality combined with downright parsimony have played such havoc with the naval strength of Britain that she would be hard put to it to hold her own even in Europe if challenged by a first class opponent.

It was in 1921 that the creation of a new naval base at this picturesque gateway of the Pacific was first foreshadowed—by Mr. Lloyd George, who was then the Premier. A mild controversy at once arose. But in 1923 work on the new base was definitely begun, whereupon the debate as to whether the building of a great naval stronghold at Singapore was strategically necessary or politically expedient became much more lively.

In the interval, events had occurred which seemed to stultify the strategical plan of which the new base was the fundament. The Washington Treaty had abolished the greater part of the British battle fleet, reducing it to 20 and eventually to 15 dreadnoughts in place of the 40 or more such vessels that otherwise would have remained in commission. Since, therefore, the ships that were to have formed the backbone of Britain's Far Eastern Fleet no longer existed, it seemed superfluous to provide a great naval base for this phantom armada.

Plan Pushed on Anyway

Nevertheless, for reasons never adequately explained, the government of the day decided to proceed with the scheme, though in a somewhat modified form. A floating dock large enough to take the largest battleships built or likely to be built was to be sent out to Singapore; a mammoth graving dock to accommodate two super-dreadnoughts at once was to be excavated, and the repair shops and other appurtenances of a big naval dockyard were to be erected, together with the gun batteries and air station necessary for the protection of the whole.

So the work went on at a leisurely pace for 12 months. Then the first Labor Government took office, and one of its earliest acts was to veto the whole Singapore business. British public opinion showed little excitement, but Australia and New Zealand were furious, both having come—somewhat optimistically, it is to be feared—to regard the new base as a guarantee of their future safety. All work at the dockyard was suspended for a year; then the Labor Government was thrown out and its Conservative successors told the Singapore contractors to go ahead again.

Glance at Singapore

Before examining the pros and cons of the Singapore scheme from a naval point of view, let us cast a glance at Singapore itself. Some one once said you could almost kick your hat from Singapore

to the Equator. Geographically, Singapore forms the appendix of the tongue of land comprising the Malay States. Technically still an island, it is physically joined to the Malay Peninsula by a road and railway causeway bridging the Strait of Johore.

After London, Liverpool, and Hongkong, Singapore is now the largest port in the British Empire. It is unquestionably one of the world's strategic key positions, being five days' steaming from India on the one hand and five days from Hongkong on the other. Clustered about it are the Dutch East Indies—one of the greatest natural treasuries of the globe—and Borneo.

To Singapore as the principal port of call in Middle Asia come argosies laden with every imaginable commodity and luxury; tin, rubber, and other products from Malaya; silk, fruit, pottery, and cereals from China; hardware, fabrics, and fancy goods from the roaring factories of Osaka, Kobe, and Nagasaki; frozen meat and wool from Australia.

Traveler's Impressions

The traveler approaching Singapore receives a confused impression of many islands fringed by forest and jungle running right down to the water's edge, seen through a shimmering heat haze. Doubtless the casual wayfarer who has looked in at Singapore thinks of the new naval base in terms of Keppel Harbor, where a dockyard has existed for many years. Actually, however, the new stronghold is on the other (northern) side of the island, nearly 15 miles from the city. It is located at Seletar on the old Johore Strait, remote and aloof from the busy mercantile traffic of Singapore roadstead.

The site was originally primeval jungle, mangrove swamp, and poisonous, steaming mud, tenanted by serpents and crocodiles. Before any serious work could be started it was necessary to deal with the mosquito pest, for the district was a hotbed of malaria.

It is in these uninviting surroundings that a great British naval base is being laboriously constructed. The felling of numberless trees and the extirpation of their immense roots, dredging on a gigantic scale, and the driving of countless piles to provide a foundation for the permanent works were the essential preliminaries.

Hundreds of swampy acres have had to be drained and rivers dammed and bridged before the construction of docks, workshops, magazines, and batteries could begin. All this is now done, or nearly done, and the naval base proper is taking shape, though it will be from three to five years before the whole scheme is completed, what then?

Powerful Navy Yard

England will have at the gateway of the Pacific a navy yard capable of docking and repairing several of her largest warships at one and the same time, with oil tanks to replenish their bunkers and ammunition dumps to restock their magazines. But where are these warships to come from? With only 12 battleships permanently in commission—the other three are laid up for repairs at any given moment—in British home waters and the Mediterranean, there will be few if any to spare for the Pacific. It is four years since the huge floating dock was towed from England to Singapore, and so far the largest warship to enter it is a 10,000 ton cruiser.

The whole trouble about the Singapore base is that it was conceived when Britain had two-power navy and will be completed when she will have barely a one-power navy. That its completion will add appreciably to British strength in the Far East is questionable. By many British naval officers the new base is regarded as a liability rather than an asset. Were friction to develop with an Asiatic power, Singapore, already a tempting prize in itself, might become with its brand-new dockyard and other naval works an irresistible magnet.

Singapore as Target

And since Hongkong could not be defended for long—its defense requiring a fleet at least twice as strong as any that could be

dispatched from Great Britain under present circumstances—the enemy would concentrate on the reduction of Singapore for the same reasons that impelled the Japanese, in their war with Russia, to concentrate on the capture of Port Arthur; namely to deprive a relieving fleet of sanctuary on its arrival in the war zone.

Singapore is very lightly held at present, and there is no evidence that its defenses are in a condition to withstand heavy attack. General Ian Hamilton fears—and many of his countrymen share his fear—that in building the Singapore base England may be fitting out a half-way house, and then, half garrisoning it as is her wont, making a present of it to the wrong people.

I have mentioned the belief current in Australia and New Zealand that the new base at Singapore constitutes a barrier against their invasion. That belief might be warranted if the empire were in a position to maintain a formidable battle fleet at Singapore; but, as we have seen, the battleships, cruisers, and other craft necessary to the creation of such a fleet do not exist. Consider, too, the immense distances which divide Singapore from the Australian ports which it is supposed to protect.

Far from Singapore

From Fremantle, the nearest Australian harbor, it is 2,400 miles; from Sydney and Melbourne nearly 5,000 miles, and from Wellington (New Zealand) 5,300 miles. No naval strategist imagines that the presence of a United States fleet at Hawaii would deter Japan from attacking the Philippines in the event of war, yet Singapore is as remote from the richest Australian ports as Honolulu is from Manila.

I do not suggest that the new base at Singapore is without value. Should the British Navy at some future time recover a substantial proportion of its former strength, Singapore may yet become the headquarters of a really powerful squadron, the existence of which would be a definite bulwark of peace in the Far East. Strategically, however, Britain's main citadel in Eastern waters is

Hongkong, which existing treaties do not permit her to equip with up to date defenses. If both Singapore and Hongkong were adequately fortified, and if Great Britain could spare eight battleships and their proper quota of auxiliary craft for permanent duty "east of Suez," the danger of war in the Far East would recede into the background.

"Challenge" to Japan

From the political point of view, its reactions have been unfortunate. When the scheme was mooted Japan at once took umbrage. She saw, or professed to see, in the new base a gratuitous challenge to her own security. On the face of it there are slender grounds for any such apprehension. No American considers Gibraltar as a menace to New York, though the distance between the Rock and Sandy Hook is approximately equal to that from Singapore to Tokyo. Nevertheless, the Japanese press "went in off the deep end," and to this day Singapore is used as a trump card in big navy propaganda. That it has had an unhappy effect on Anglo-Japanese relations is undeniable.

Surely the wiser course would have been to modernize the existing naval works at Keppel Harbor, adding a floating dock large enough to take the largest men-of-war. This could have been done quietly, and probably would have evoked no more attention in Japan than the development of the United States base at Pearl Harbor, Honolulu, has done.

Unpalatable as the admission may be, the goodwill of Japan plays an important part in the security of the British commonwealth of nations. Such naval forces as Britain could muster in the Pacific at short notice would be quite incapable of shielding our far-flung territories and our floating trade in that sphere. On any given day of the year \$800,000,000 worth of British ships and cargoes are afloat in the China Seas, Australasian waters, and the Indian Ocean. Yet the utmost force Britain could deploy anywhere within that area does not exceed a dozen cruisers—half of them obsolete—with a flotilla of destroyers and one of submarines.

The Development of Publishing Business in China

By YAO HSIN-NUNG

THE first to use the art of printing, China is probably the last in the modern world to develop it. When mediæval monks laboriously inscribed works on vellum, Chinese scholars had already been enjoying the luxury of exquisitely printed books for centuries. Embossed boards and movable type, both wooden and metallic, were used by Chinese printers long before Gutenberg "invented" printing.

But although publishing in China has a history which goes back to the second century, its modernization did not begin until the nineteenth century. For 17 centuries innovations were few, and progress incredibly slow. Reasons for such snail-speed development were essentially economic. First, in old Chinese society, education was practically monopolized by the scholar class, which constituted but a negligible percentage of the entire population. The great masses of illiterate peasants, merchants and manual laborers, had neither the need nor the money nor the education for books. There was little need for newspapers and periodicals which can thrive only when mass literary development begins. The scholars were themselves satisfied with the official *ti-pao*, a kind of paper containing the news of the Imperial Court, which regarded the business of the ruling class as no affair of the people. The popular news source for long remained the tea-shop or wine-house in the market where people ate, drank, talked, met their friends, transacted business, listened to story-tellers and sing-song girls, and learned what they would of "the world."

Secondly, the classics studied by the scholars were the same old texts handed down through generations and there was little demand or indeed, any reason, for new books. And since there were few books there was no growth of publishing business. Moreover, in the absence of large scale production and industrial advancement, the cost of production of such books as saw print was extremely high, far beyond the average purchasing power. Hence, not infrequently books were preserved, to be used for many generations. The more impoverished scholars even preferred to copy the Classics

rather than buy new books. Such circumstances did not favor the development of the publishing business and China lagged far behind in the field.

In the past fifty years, publishing has at last become a modern industry in China, making considerable progress—technically and economically. But, in view of China's vast territory and population, what had been accomplished is a mere beginning. The Japanese learned the modern art of printing no earlier than Chinese, yet in 1930 she produced 18,029 new books, ranking second only to Germany, among nations of the world. In the same year the estimated number of new books published in China was not more than 1,000!

One may, of course, blame the government for neglecting mass education. But it is fruitless for publishers to lament the impotence of a government hopelessly involved in debt and civil war. They should adopt measures of their own, instead of "letting Chiang do it."

A Task for the Publishers

The truth is that China's publishers ought to do something to create popular demand for books, and then exert themselves energetically to meet that demand. Up to the present, they have catered solely to the intellectual class, particularly the students, who constitute not more than 1.88 per cent of China's total population. Periodicals and newspapers are read only by the educated few, and great publishers such as the Commercial Press, the Chung Hwa Book Co. and the World Book Co., have survived mainly on their textbooks. There is a deplorable scarcity of publications intended for mass consumption wherein is an unexploited field of limitless possibilities, on which the Chinese publishing business, if it is to expand, must in the future concentrate.

In other words, the publishing business of modern China is still waddling in the beaten track of intellectual patronage. Its growth till now has been parasitic. In its century of modernization it has prospered mainly from the mechanical facilities taken from the

West and the increase in demand for books as a result of social changes in China,—not from its own exploitation of the field. In connection with these generalizations it is interesting briefly to trace the development of modern Chinese publishing institutions.

Printing in China first began in the Han Dynasty, in the 4th year of the reign of Hsi P'ing (175 A.D.) when the Confucian "Five Canons" by Imperial edict, were engraved on stone tablets in front of the "Grand Academy," enabling the people to get free rubbings therefrom. About 400 years later, in the 13th year of the reign of K'ai Huang, Emperor Wen of the Sui Dynasty decreed, according to Lo Shên's *Ho Fen Yen Hsien Lu*, that "all existing canons be engraved on wooden boards" for printing. This is the first record of book-printing in history, though the actual beginning seems to have been even earlier. In the T'ang Dynasty, an "ink board" was used in Szechuen and Yo K'o mentioned in his *Instances of Transmission of the Nine Canons and Three Commentaries*, that there was a "brass-board edition" in the reign of Tien Fu (936-946).

We do not know whether any kind of newspaper was published as early as these books. It is said that a kind of primitive paper called *ch'ao pao*, or the "Court herald," existed even in the Chou Dynasty, several centuries before the Christian era, and that the *ti-pao*, or "Residence herald," was sent to the Han feudal lords from their own residences at the Capital to keep them informed of central political affairs. However, there is no evidence that these "heralds" were anything more than private information or that they were printed. In later periods, the *ti-pao* gradually expanded.

The Earliest Newspapers

The Anecdotes of the T'ang Poets tell of some one knocking at a poet's door and congratulating him on being appointed to fill a vacancy mentioned in the *ti-pao*. From this we may assume that in the 8th century (or earlier?) a crude, political paper containing Imperial edicts, memorials and Court and political news, seems to have become the current reading of courtiers, officials and probably even of scholars. Another kind of paper known as *K'ai Yüan Miscellaneous Herald* prevailed in the reign of Emperor Ming Huang of the T'ang Dynasty, but we have no idea of its nature, and contents, nor whether it was actually printed.

The use of movable type was invented in the reign of Chin Li (1041-1048), by Pi Shên who carved characters on separate clay blocks. In the Mongol Dynasty, Wang Chen wrote *The Method of Book-printing with Movable Type* which is probably the earliest literature concerning the art of printing. In the reign of Hung Chih (1488-1505), Hwa Sui improved on the clay blocks by making them of brass. Later, Chin Chien, a Korean, made a set of jujube-wood type and presented it to Emperor Chien Lung, who stored it in Wu Ying Hall and gave it the name, *Tsü Chen Pang*, or "Collected Gem Type."

The movable type, however, was not generally used, despite its improvement over the embossed boards. It was too expensive to make a set of blocks sufficient for book-printing, since every Chinese character requires a separate type, and it was inconvenient to find a particular character in the set, to return it to its place, and to reset when the book was to be reprinted. The "Collected Gem Type" of Emperor Chien Lung was used, it is true, to produce 800 different books, but it was an expensive undertaking, made possible only by Imperial patronage.

The first attempt to improve the old Chinese typographical method was made by Robert Morrison in 1807, when he secretly employed Chinese engravers to make movable type, after the Western fashion, for printing his translation of the Bible. But, because of the prohibition of the Manchu authorities, it was destroyed when half finished. It was, however, finally printed in 1819. From then to the Sino-Japanese War of 1894, the Western art of printing gradually developed in the treaty ports through the effort of missionaries. It was mainly for producing religious literature, but two or three missionary publishers did produce a few books of cultural nature. Anti-Christian feeling then prevailed among the Chinese, and such books enjoyed little popularity.

Activities of Foreigners

In the meantime, the gradual awakening of China was creating a popular demand for news. In Hongkong and Shanghai foreigners put out Chinese newspapers which steadily grew in circulation. The Hongkong *Chung Wei Hsin Pao*, probably the earliest modern Chinese newspaper, appeared in 1854. The Shanghai *Shun Pao*,

largest Chinese paper of to-day, was founded in 1872 by E. Major, an Englishman.

Major also established a lithographic printing house known as *Tien Shih Tsai* which proved to be a profitable enterprise. Its first reproduction of the famous *Kang Hsi Dictionary*, amounting to 40,000 copies, and the second edition of 60,000 copies, were both sold out in a few months. After this amazing success, Chinese publishers lost no time in opening lithographic printing houses of their own. By means of photography, they reduced the big, clumsy Classics to handy volumes or to the so-called "sleeve's gem" size—a great convenience to the scholars who had to journey to Peking or to a provincial capital to take their literary examinations. According to an expert estimate, the annual sales of lithographed books at that time amounted to about \$2,000,000. However, following China's defeat in the Sino-Japanese War, the literary examination was abolished, ending the prosperity of this brief "age of stone" and inaugurating a new period in the history of China's publishing business.

This period was opened with the Reform Movement led by Kan Yu-wei and Liang Chi-chao who advocated "a change from the old to the new." They won so much public sympathy that by 1898 the Manchu Government had to displace the system of literary examination with modern schools. This and the nationwide inclination for Western learning, especially after Japan's quick ascendancy, stimulated the circulation of newspapers and the production of new books. Publishing houses and Government "book bureaus" appeared in mushroom growth in big cities, harnessing their machines for a new market, and many missionary printers entered into the race.

In the dawn of this period, the commercial publishing houses were far less powerful than either the Government or the missionary institutions. The business expansion of the missionary printers may be inferred from *Kwang Hsueh Hui* whose annual sales, \$800 in 1893, had bounded to \$250,000 in 1903.

In a few years the commercial publishers forged ahead and took lead in the field. By 1906, 83.3 per cent of the primary school textbooks passed by the Manchu Ministry of Education were published by non-government Chinese houses, which had increased rapidly both in size and number. In that year, in Shanghai alone, the membership of the Publisher's Union went up to 22, among which the Wên Min Book Co., for instance, did an annual business of \$300,000 with a capital of \$50,000. Toward the fall of the Manchu Dynasty, the annual publishing business was estimated at \$5,000,000 in total, of which the Commercial Press claimed about 30 or 40 per cent.

Development of Publishing

The publishing business continued to grow after the 1911 Revolution, and was greatly accelerated by the "New Literary Movement" which began in 1917. Previously, the main scope of publishing was confined to books of fiction, law, political science and, most important of all, school text-books. The surging Movement opened new opportunities to all publishers, not only for books in the vernacular *pei-hua* but also for revaluation of the discarded classics, translations of works of world culture. The resultant boom in the so-called new cultural book market and the keen demand for modern periodicals gave rise to many more new publishers. The *China Year Book of 1927* (Japanese) listed 326 newspapers and 142 periodicals, of which about two-thirds were newly issued. The *Index of Translations of Foreign Literary Works* for 1929 shows 48 concerns engaged in this branch of publishing.

In the meantime the "Library Movement" loomed in the horizon and materialized in 1928, when a resolution was passed in the National Educational Conference, requesting the Ta Hsüeh Yüan to order all schools to establish libraries and to devote 5 per cent of their annual funds to purchasing books. The big publishers immediately seized the opportunity to produce cyclopedic series such as the *All-containing Library*, the *Annals of 24 Dynasties*, the *A.B.C. Series*. The lesser publishers, being handicapped by small capital, concentrated their energy on the "new-cultural" market. This is one reason why comparatively small concerns—notably Pei Hsin, La Contemporain, Kai Min, Crescent Moon, etc.—have practically become the major publishers of new literary works.

Up to 1931 the Chinese publishing business had enjoyed an almost uninterrupted growth. In Shanghai alone, the Publisher's Union registered more than 40 members with a total capital of about \$9,000,000, in addition to some 60 non-members whose

combined capital approximated \$6,000,000. Their annual business was estimated at \$30,000,000 of which 50 per cent went to the three leaders—namely, the Commercial Press, the Chung Hwa Book Co., and the World Book Co.

Riding on winged prosperity, the Shanghai publishers experienced a sad fall when Japanese bluejackets came to blows with the 19th Route Army in the night of January 28, 1932. The next morning Chapei, the center of book-binding industry and the location of several publishing houses including the huge plant of the Commercial Press, was all aflame under bombing planes. This fatal blow stunned Shanghai, the center of China's publishing business, causing all publishers to suspend operations for several months. The Commercial Press, suffering a damage of \$16,330,504 or above three times its capital, was unable to resume business until August of the same year.

The Shanghai War, however, paradoxically started a boom in newspapers and periodical literature. Latest statistics show 3,331 such publications registered with the Ministry of Interior up to the end of 1933, an increase of 711.75 per cent in comparison with the figure of seven years ago. The nation-wide indignation toward foreign aggression, of course, is responsible for such a striking development but the general discontent with the Government is perhaps a stronger incentive.

Revival of Book Market

The book market in the meantime revived. Towards the end of its unlucky year, the Commercial Press announced a plan to publish "a new book a day," in addition to new textbooks and cyclopedic literature. Others also advertised their new publications and some non-textbook producers took opportunity to publish school readers which had been in keen demand as a result of the temporary closure of the Commercial Press. Several concerns that were formerly mainly newspaper or periodical publishers in nature, issued books too, as a sideline. There are no statistics showing the total number of new books published since the Shanghai War. But, it is unlikely that the figure is lower than that of 1931, since the Commercial Press, heaviest sufferer of all, was able to put out 1,300 new books and reprint 3,500 old editions in 1933.

As for the future of China's publishing business, one may wax optimistic in view of the vast potentialities of the 400 millions. Were all Chinese educated, China would indeed surpass all nations in the consumption of books. But, when can this "if" be dispensed with? If the rate of progress in China continues as slowly as in the past, it may take a century or more. Who knows? It does not seem likely that popular education will be seriously undertaken by the present government for some time to come. The hope of material government assistance to the publishing business is equally remote. Thus far it has actually obstructed progress. Last year, for instance, there was a list of "reactionary" books prohibited by the Government, which even Herr Hitler would be pleased to have in his library.

In olden days, the development of the Chinese publishing business was arrested because it relied chiefly on the literati. Viewed from the perspective of five decades, it has made considerable progress, as may be seen from the following statistics of the Commercial Press, which represents about one-third of China's entire publishing business.

	Year	Capital	Business	Books published
(Established)	1897	\$ 4,000	—	—
	1910	1,000,000	\$1,731,695	127
	1920	3,000,000	5,806,729	352
	1930	5,000,000	12,055,473	439

But, strictly speaking, the progress is derived from a demand that has grown spontaneously, not from one that is created with effort. In other words, it is a passive instead of an active progress.

The position of Chinese publishers calls for their taking active part in the propagation of education. The natural increase in the number of students on whom they have depended is slow and gradual, and the inevitable competition resulting from the steady increment of publishers makes "the congee inadequate for too many monks." Under such circumstances, the growth of publishing business is narrowly limited. Take, for instance, the business report of the Commercial Press since 1922 when its capital was increased to \$5,000,000:

Year	Business	Annual business increase	Year	Business	Annual business increase
1922	\$6,909,896	.75% (over 1931)	1927	7,917,733	-18.70%
1923	8,150,195	17.94%	1928	10,135,679	28.01%
1924	9,117,401	11.86%	1929	11,668,012	15.11%
1925	8,768,299	-3.83%	1930	12,055,473	3.32%
1926	9,738,087	11.06%			

Average business increase in nine years 7.28%

An annual average increase of 7 per cent in a nation with millions of potential readers is certainly far from impressive. To overcome such limitations, it is obviously necessary to extend the book market beyond the 1.88 per cent students to the 95 per cent illiterates of the Chinese population. This can only be achieved by means of actively assisting the mass education movement which has been already begun by several social institutions. In one year the National Association of that movement succeeded in converting 14,210 illiterates in Ting Hsien. If the same thing were done in the 1,939 *hsien*-districts of the entire nation, there would be approximately 17 million new literates each year, or twice the total student population, ready to read and buy books. The leading Chinese publishers, having their branches in almost all provinces and big cities, are in excellent position to do this work which will profit not only themselves but the nation as a whole.

Major Possibilities Ignored

But they have not contemplated this idea. Most of them apparently do not care to produce books for mass education and those who do so are content with a few volumes, shrinking timidly behind a huge army of other books. Instead, they hotly compete for the business of the handful of educated men rather than helping to banish illiteracy and create new markets. Even most Chinese newspapers still cling to the classical style of writing, despite 15 years of the vernacular movement. This is probably why none of them have a circulation larger than 150,000 copies.

The lack of desire to popularize books is also manifested in their prices. Average books are sold at 50 cents or more, an unattainable luxury for the masses. Under efficient management, the cost of production could be brought down considerably. For instance, 60 per cent of the machinery of the Commercial Press was incapacitated and its workers reduced by 50 per cent, after the Shanghai War, yet its productive capacity is at present two and a half that of two years ago. Publishers can make just as much profit by avoiding waste and inefficiency and minimizing the price of books, as they can *vice versa*. The mass education books used in Ting Hsien are sold for four cents a copy and yet they yield a yearly profit of over \$10,000 to their publishers.

In short, the future possibilities of China's publishing business are immense, but their realization depends on how soon the Chinese publishers will take active part in the mass education movement. It requires a certain amount of work and investment to begin with but the result will richly repay the undertaking. At present, the Chinese publishers gaze at the foreign book market with great admiration. Their entire yearly business is only one half the annual income of a single American weekly magazine, the *Saturday Evening Post*! An old Chinese proverb well says: "It is better to go home and knit a net than to covet for the fish in deep water."

Must America Fight Japan?

(Continued from page 200)

down by Mr. Stimson in his open letter to Senator Borah on the necessity of holding the Philippines, they can also find a formula that will enable them to recede from the Stimson Non-Recognition Doctrine without loss of dignity or honor. Both doctrines are interrelated. One cannot be enforced without the other.

The President's Message on Philippine Independence is an assurance to Japan that we have no aggressive designs in the Orient. It is one more advance towards the goal of world peace and understanding. There are other indications that the diplomacy of Roosevelt and Hull is seeking a way out of difficulties which past administrations have permitted to pile up to where they now constitute a real barrier to friendly relations with Japan. I have every confidence that the will to peace on both sides will smooth out these misunderstandings and pave the way to a permanent peace in the Pacific.

The Sunning Railway

By Mr. CHIH YU, Superintendent of Motive Power, Sunning Railway

Most Americans who have lived in China for any length of time, or have toured the country to any extent, have had occasion to travel by rail between Shanghai and Nanking, or between Tientsin and Peiping, or between Tsingtao and Tsinan or between Kowloon (Hongkong) and Canton.

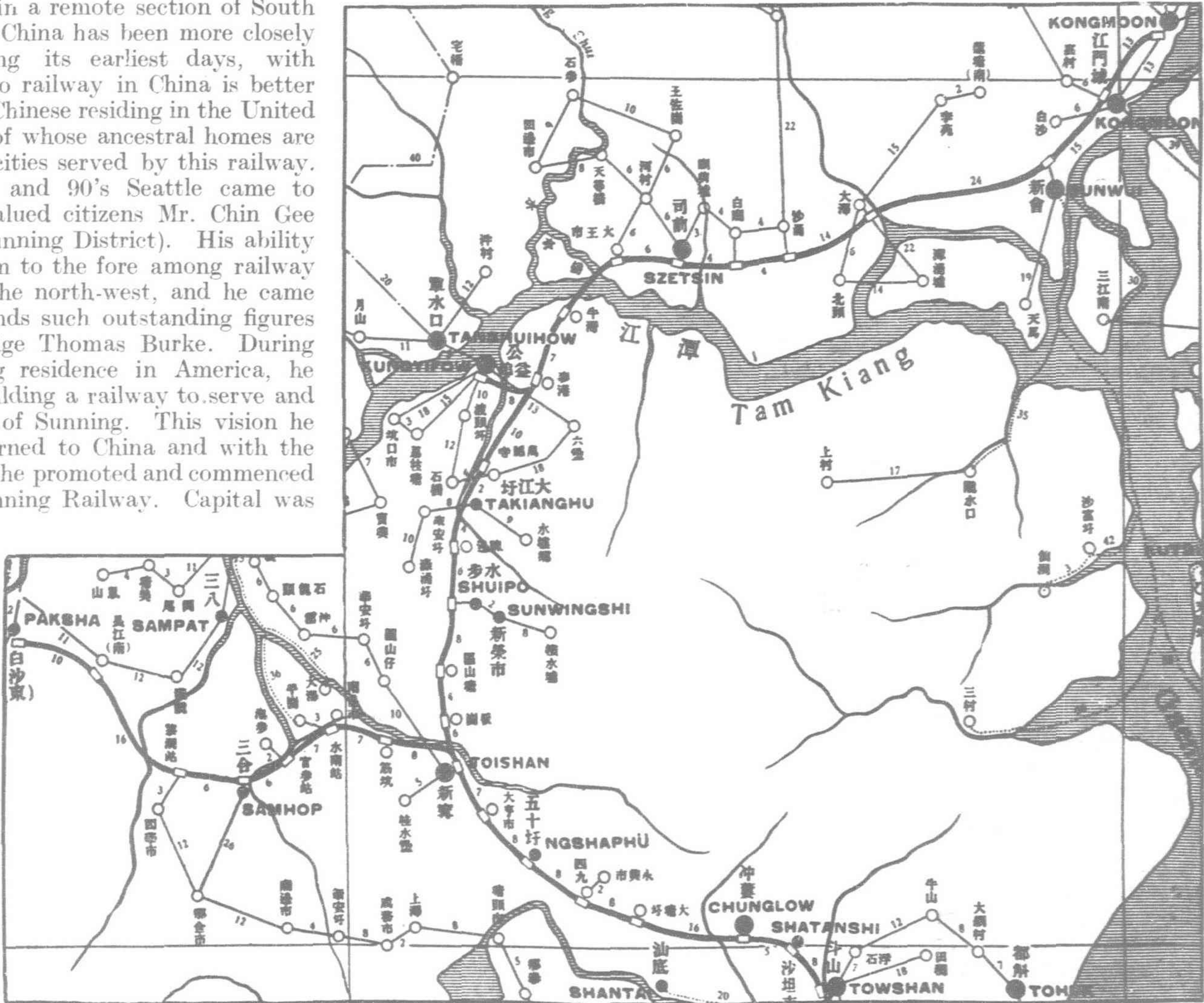
But few of them have traveled over the Sunning Railway, tucked away as it is in a remote section of South China. Yet no railway in China has been more closely identified, especially during its earliest days, with American interests; and no railway in China is better known to the thousands of Chinese residing in the United States, a large percentage of whose ancestral homes are located in the towns and cities served by this railway.

During the 70's, 80's and 90's Seattle came to appreciate as one of its valued citizens Mr. Chin Gee Hee (a native son of the Sunning District). His ability as a contractor brought him to the fore among railway construction engineers in the north-west, and he came to number among his friends such outstanding figures as James J. Hill and Judge Thomas Burke. During the latter part of his long residence in America, he conceived the vision of building a railway to serve and develop his native district of Sunning. This vision he realized. In 1905 he returned to China and with the assistance of Mr. Yu Cheuk he promoted and commenced the construction of the Sunning Railway. Capital was subscribed by Sunning-born Chinese friends, both in America and in the Sunning District itself.

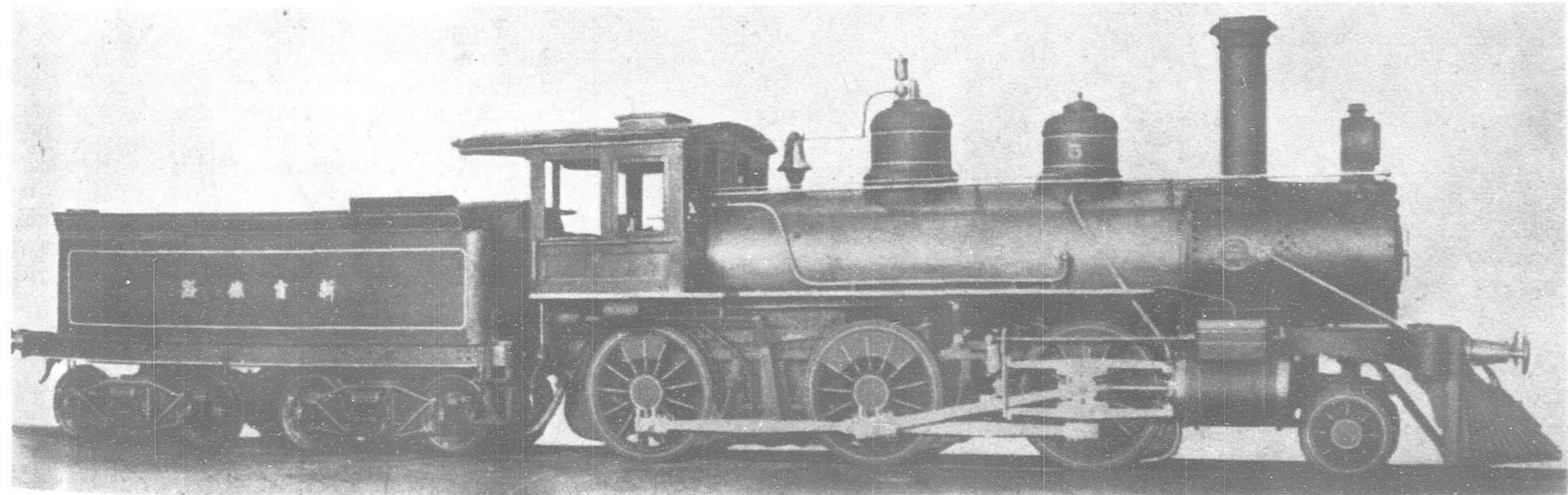
The following extracts from a letter written in 1922 by Mr. Chin Gee Hee to the Seattle Chamber of Commerce (of which he was elected an Honorary Member in 1917), give a picturesque résumé of the early history of the Sunning Railway as well as an insight into the attractive personality of the promoter himself:

"I was in Seattle for nearly forty years before

my last departure for Asia in 1905, which was only for the purpose of developing the dream of my younger days in Seattle, the construction of a railroad through my old home district in Sunning. At first there were many obstacles which stood in my way, but my intention to accomplish the plan was like an arrow shot from



Map showing Lines of the Sunning Railway



A Mogul (2-6-0) Type Locomotive built by the Baldwin Locomotive Works for the Sunning Railway in 1907

Track gauge	4-ft. 8½-in.	Drivers, diam	54-in.	Weight on drivers	68,620 lb.
Cylinders	15-in. by 24-in.	Heating surface	936 sq. ft.	Weight, total engine	82,720 lb.
Steam pressure	180 lb.	Grate area	14 sq. ft.	Traction force	15,300 lb.

the bow which does not wander around to see what it can hit on its way, but flies straight to the mark. Of course, at that time transportation was nothing to the people. They thought a railroad was going to damage them. Now everything has changed. Two years ago the people of the lower Sunning District fought among themselves for a railroad to go there."

"Back in 1905 we started to build a railroad with a capital of three million dollars. I wish all you gentlemen if you have any time will come to China. I would like to have a trip with you in my train, covering the whole length of the line from Pakkai to Towshan, a distance of about 85 miles. Our main machine shop is in Kung Yik City, from which we can manufacture everything, except the locomotive."

"I had all my railroad experience in Seattle, where I was once a track laborer, a contractor and afterwards one of the contracting builders of the old Front Street cable line. Many years later Judge Thomas Burke and J. J. Hill of the Great Northern Railroad, arranged for me to be given a trip over some of the principal railway lines of the country. That was my opportunity to add to my knowledge of railroad construction. Could I ever be what I am if it wasn't for Seattle men? None of those will be forgotten from my heart. I think the people of Southern China all owe Seattle a great debt of humanity's happiness. As for myself alone, I have nothing more to say only that Seattle gave me the biggest gift that made me the President of the Sunning Railway Company. Well, boys, I am 78 years old to-day, old enough in age, but still very mighty in energy, I will go to Seattle to see all of you again, and if God does not allow me to do so, I will meet all you boys up in Heaven."

In 1905 a capital of about (Mex.) \$3,600,000 was raised. In 1909 the section of line from Towshan to Kung Yik (54 miles) was opened

for traffic. Progress was very much hindered by the superstitions of the uneducated country folk over whose land the line had to pass and who honestly trembled over the prospect of the fire-spitting dragons which would eventually be rushing by their peaceful farms.

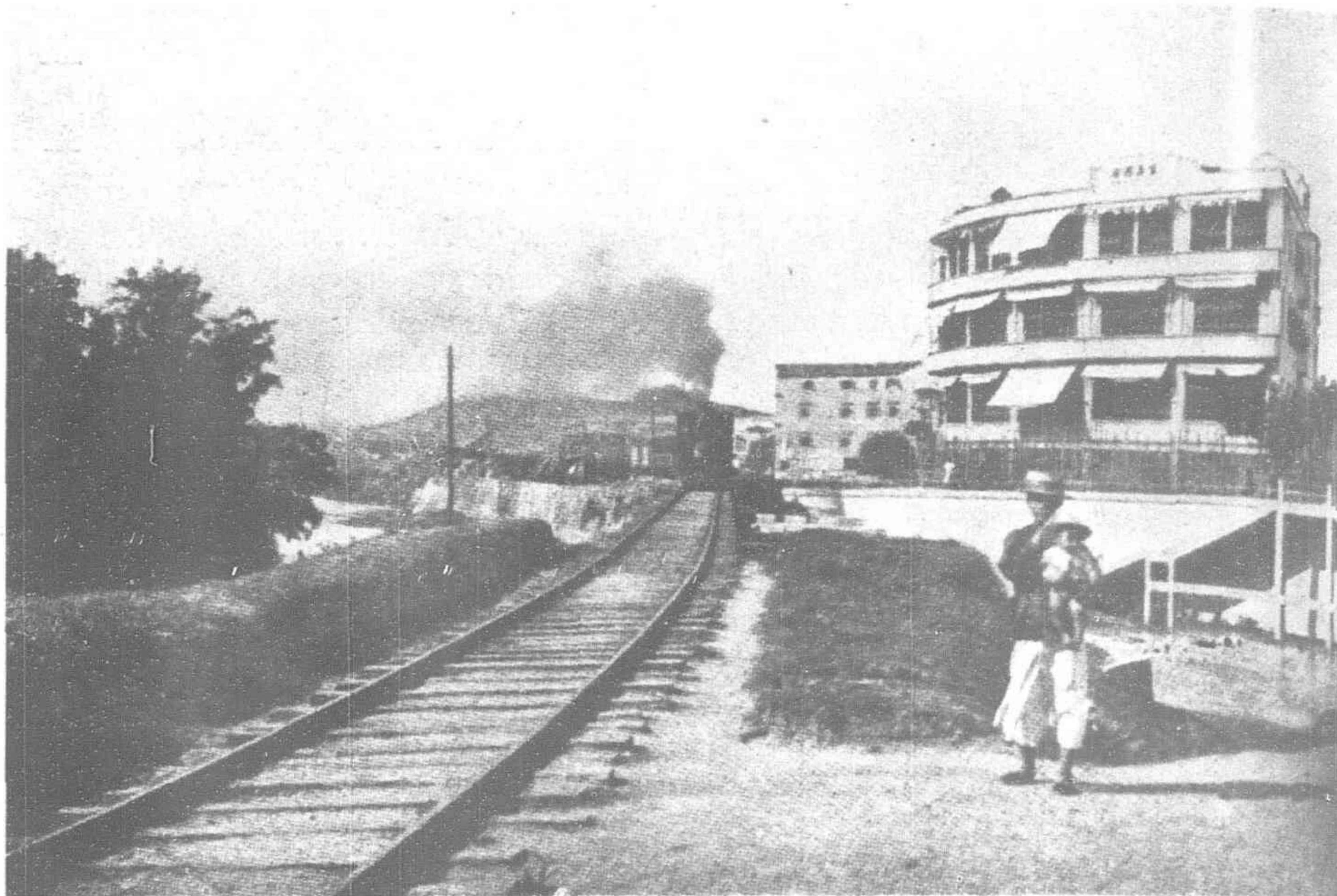
In 1913 the section from Kung Yik to Pakkai (26 miles) was opened for traffic. In 1920 a branch line from Toishan (Sunning) to Paksha was completed (21 miles).

The initial construction of the railway carried it up and down 1 in 120 grades and around 15 degree curves from Towshan to Kung Yik on the bank of the Tam River. Here the railway's workshops were built. Locomotives purchased from abroad were tranship-

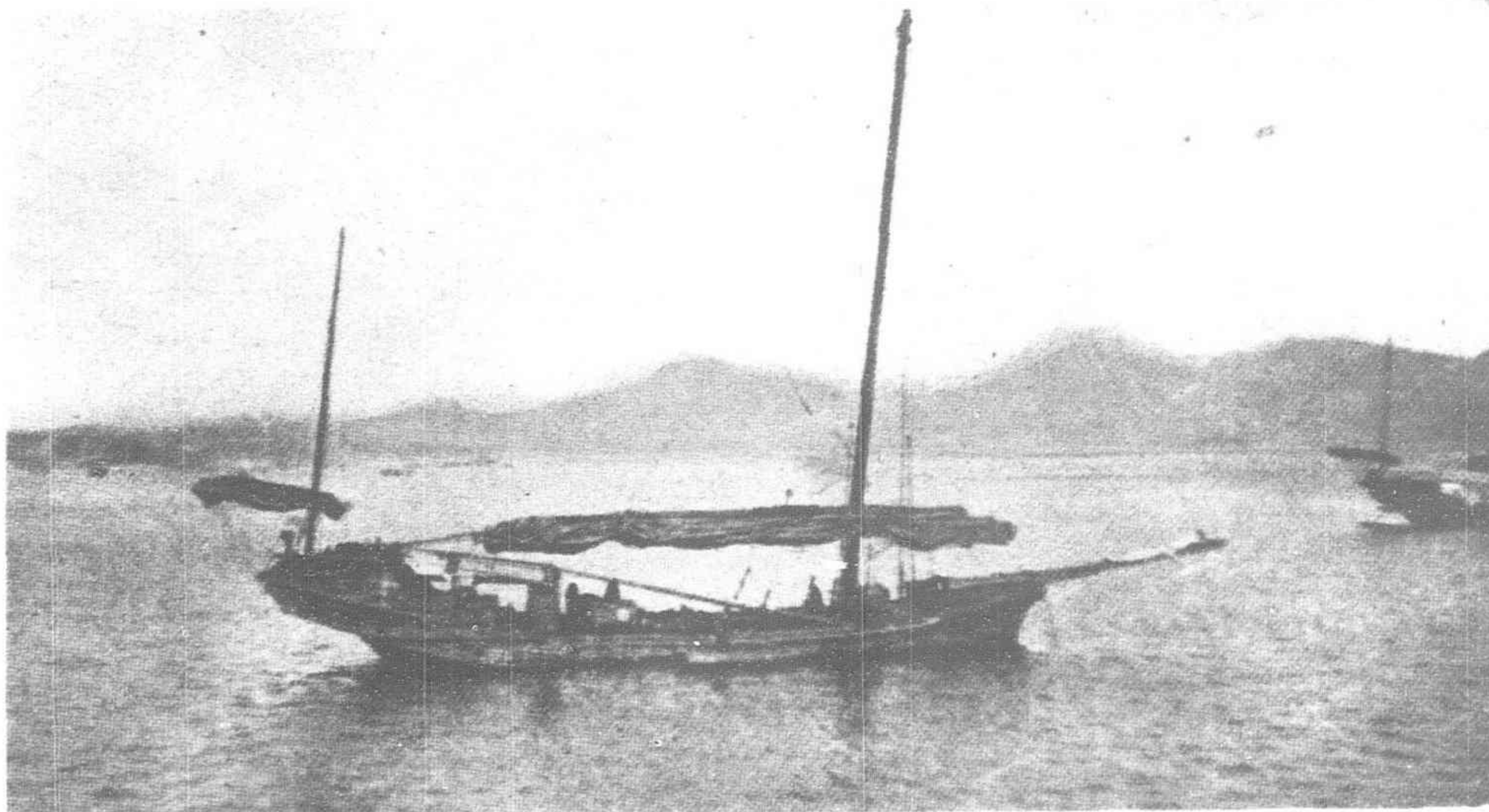
ped from ocean liners at Hongkong into Chinese junks which eventually found their way to Kung Yik where they were unloaded and assembled.

From Kung Yik the line was laid parallel to the Tam River, for a distance of about five miles, to the point where it had been decided to establish a ferry to carry trains across the river. The river at this point is about one-quarter of a mile wide. The cost of a bridge was beyond the financial capacity of the railway in those early days, and so came into being a train ferry which, we are willing to venture, is more unique and interesting than any other actually in operation to-day.

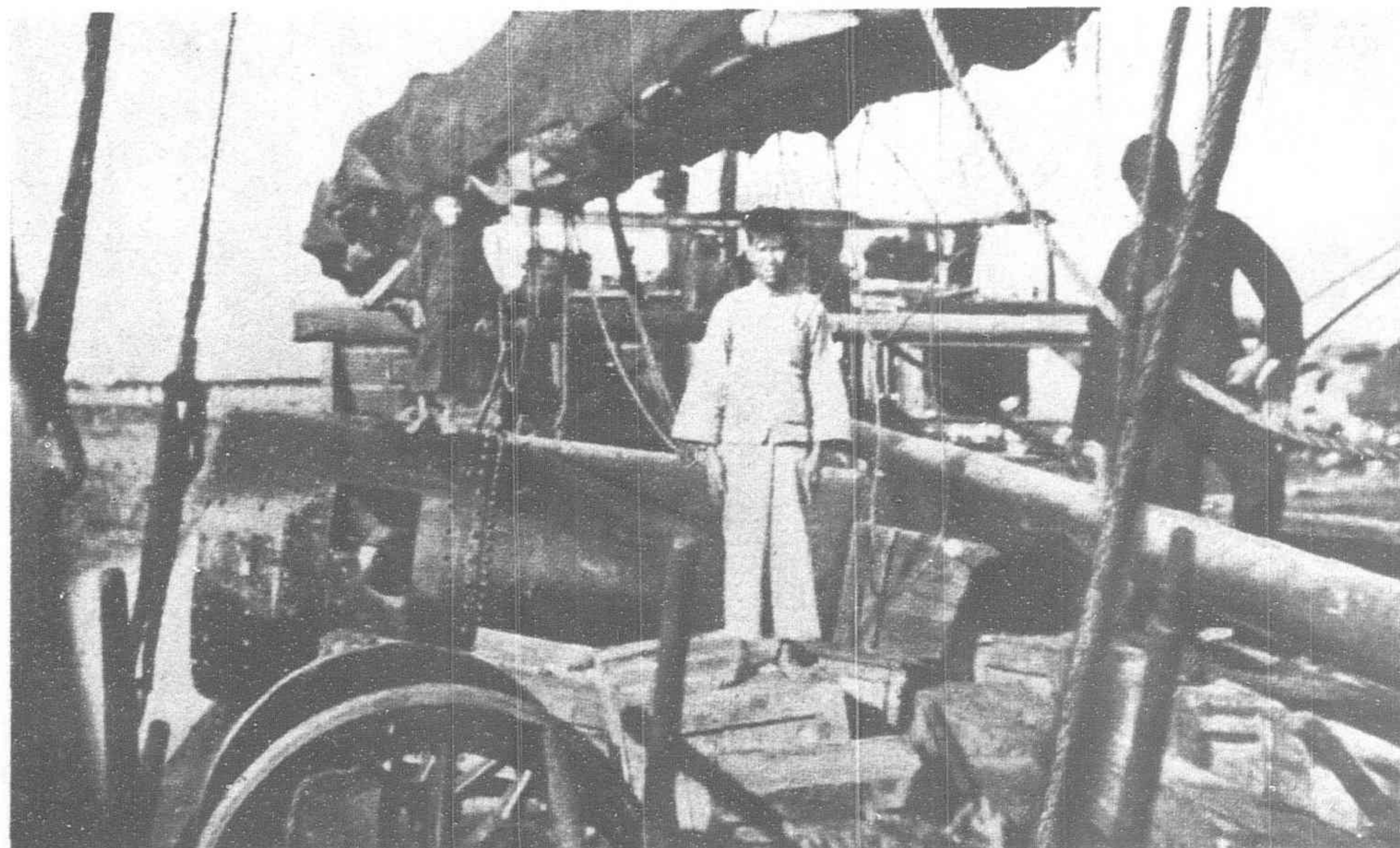
The ferry, a steel pontoon 350 feet long and 50 feet wide, capable of accommodating one locomotive and three passenger coaches, was constructed at the Kwong Tack Cheong Dock of Hongkong in 1911. Only a single track is laid along its length. The balance of its ample width is given over to a boiler house, a number of steam winches, large and numerous coils of steel rope and two stalls for venders of cakes, fruit, hot food and other eatables which are generously patronized by



A Scene along one of the Branch Lines of the Sunning Railway



Chinese junk carrying material for Baldwin locomotives from Hongkong to Kung Yik where they were re-erected

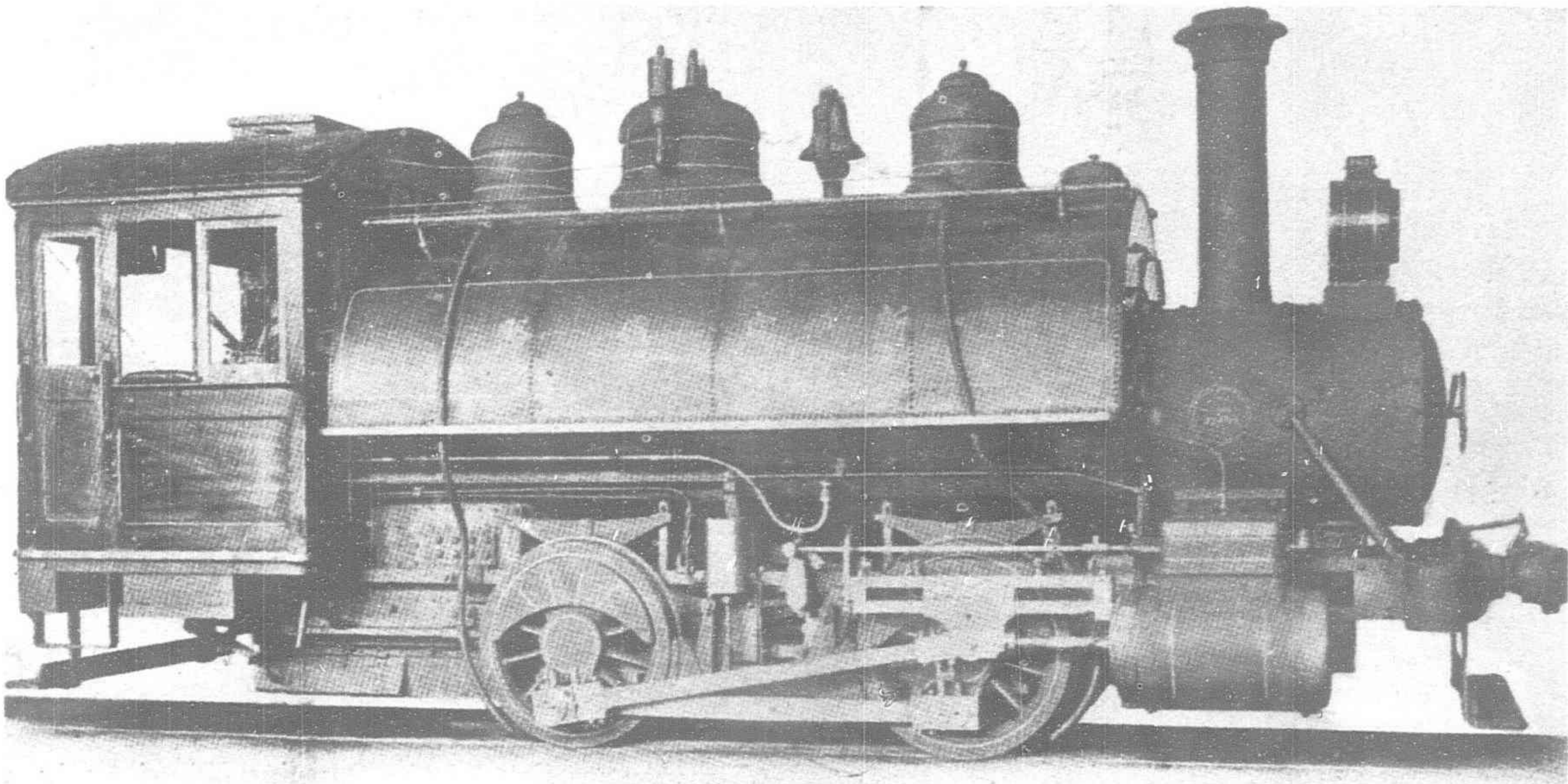


Scene on board the Chinese junk showing a boiler, driving wheels and other locomotive parts

the trains' passengers during the leisurely voyage across the river.

Propulsion of the ferry is accomplished by pulling on two parallel lengths of wire rope which are stretched across the river about 60 feet apart. The ends of these cables are firmly anchored on each bank of the river. There is sufficient slack in them so that they normally lie on the river bottom and do not interfere with the river craft. These ropes are passed around the drums of the steam winches mounted on each side of the deck of the pontoon, which is thus dragged through the water. A fairly swift current in the river tends to pull the rudderless pontoon out of line. The captain of the ferry, from the bridge deck, directs the operators of the steam winches to slow down on the port side and speed up on the starboard side—or whatever other maneuvers are necessary to keep the pontoon headed for the rail end on the opposite shore. Under these circumstances the trip is necessarily somewhat slow ; consuming about half an hour.

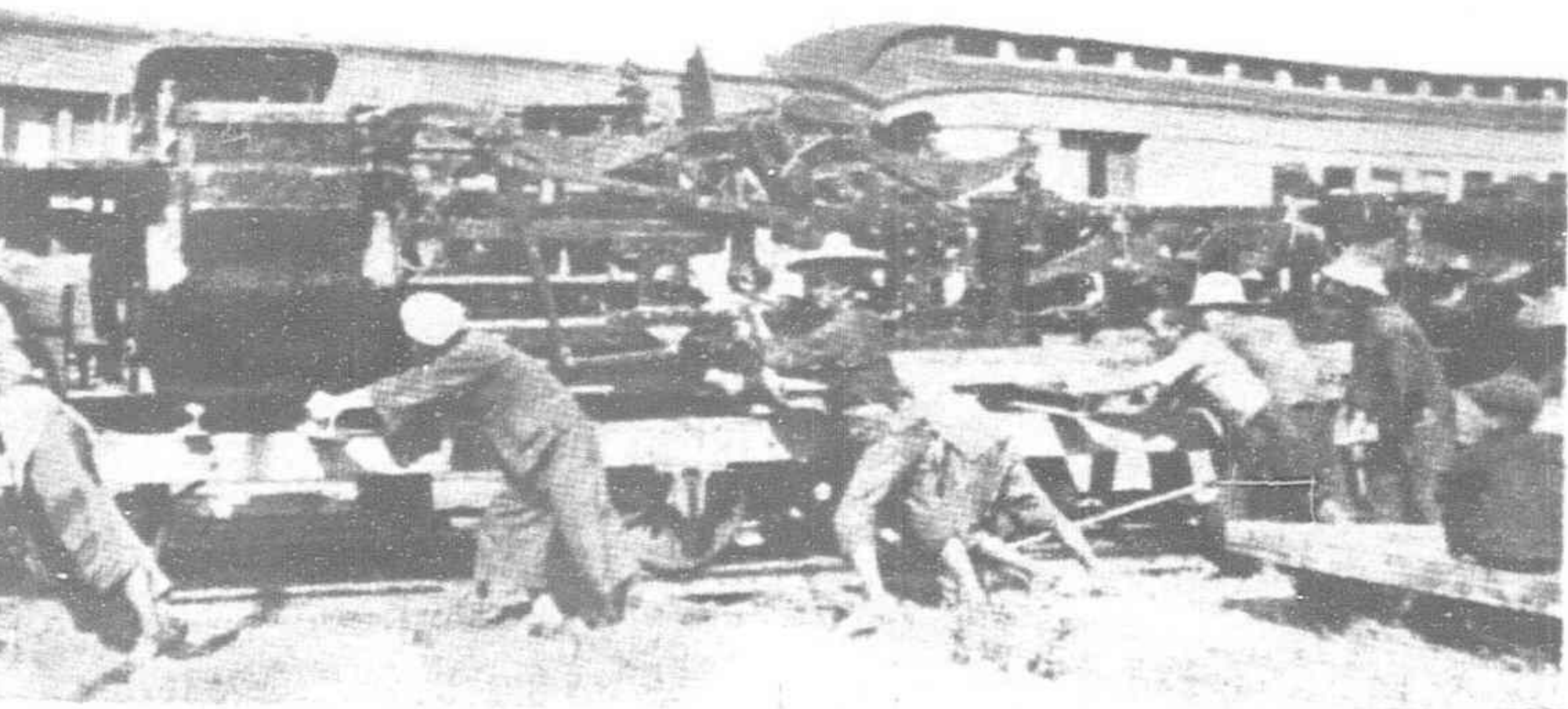
The railway management has now been able to finance the building of a bridge across the Tam River, and it is now practically completed. The bridge, which will not be located at the site of



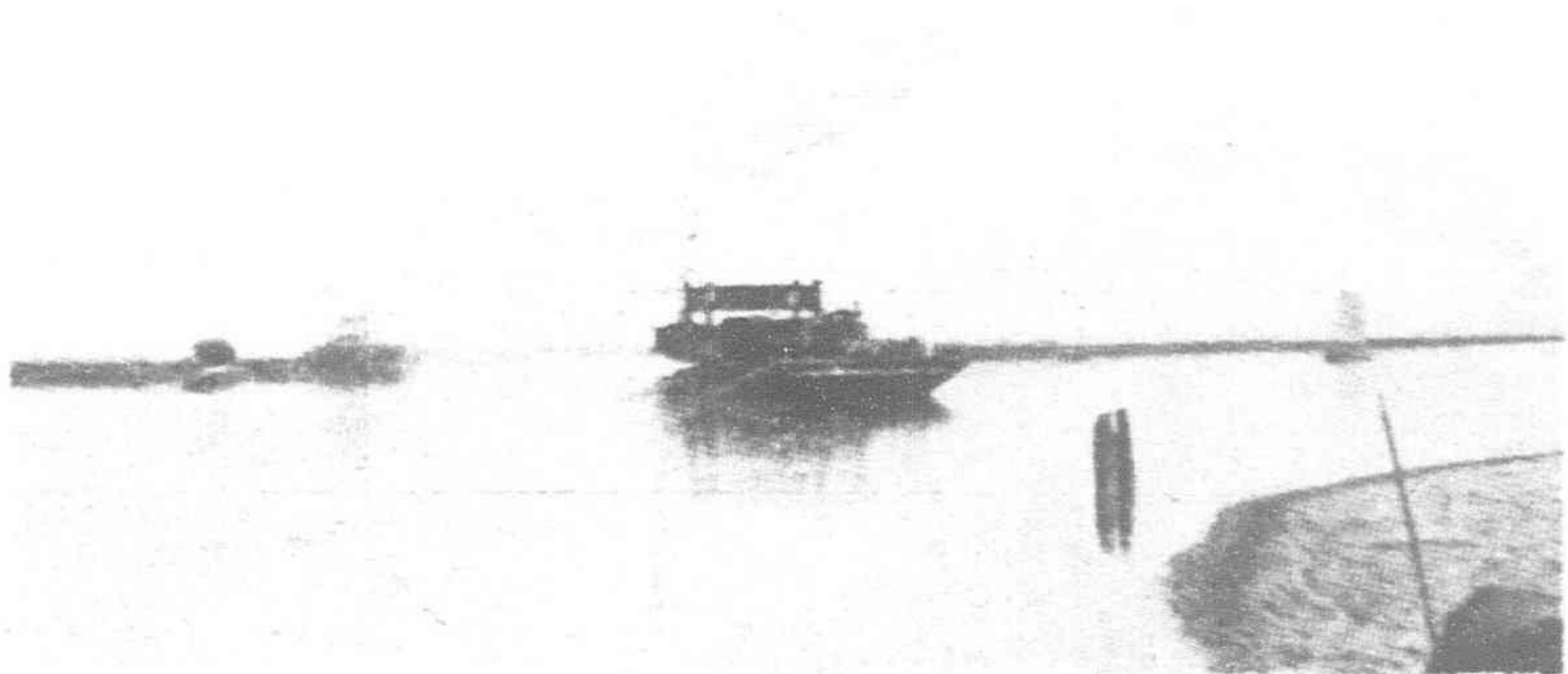
A Baldwin 0-4-0 type, Saddle Tank Locomotive built for the Sunning Railway in 1908

Track gauge ..	4-ft. 8½-in.	Drivers, diam ..	44-in.	Weight on drivers ..	81,050 lb.
Cylinders ..	15-in. by 24-in.	Heating surface ..	718 sq. ft.	Weight, total engine ..	81,050 lb.
Steam pressure ..	180 lb.	Grate area ..	15 sq. ft.	Tractive force ..	18,770 lb.

In 1913 the line from the east bank of the Tam River through to the present eastern terminus at Pakkai was completed. This section of the road is 26 miles long and passes through such important cities as Sunwui and Kongmoon. Pakkai, just three miles from Kongmoon, is a treaty port situated on the Si Kiang River. Several river steamers, averaging about 500 tons, make daily



The frame and cylinder assembly of a Baldwin Locomotive being moved from the dock at Kung Yik to the shops of the Sunning Railway



Crossing the Tam River on the old train ferry which is now being replaced by a modern bridge

the train ferry, but at Kung Yik, will have eight fixed spans, each 162 feet long and one bascule span 68 feet long. It will thus have a total length of 1,364 feet.

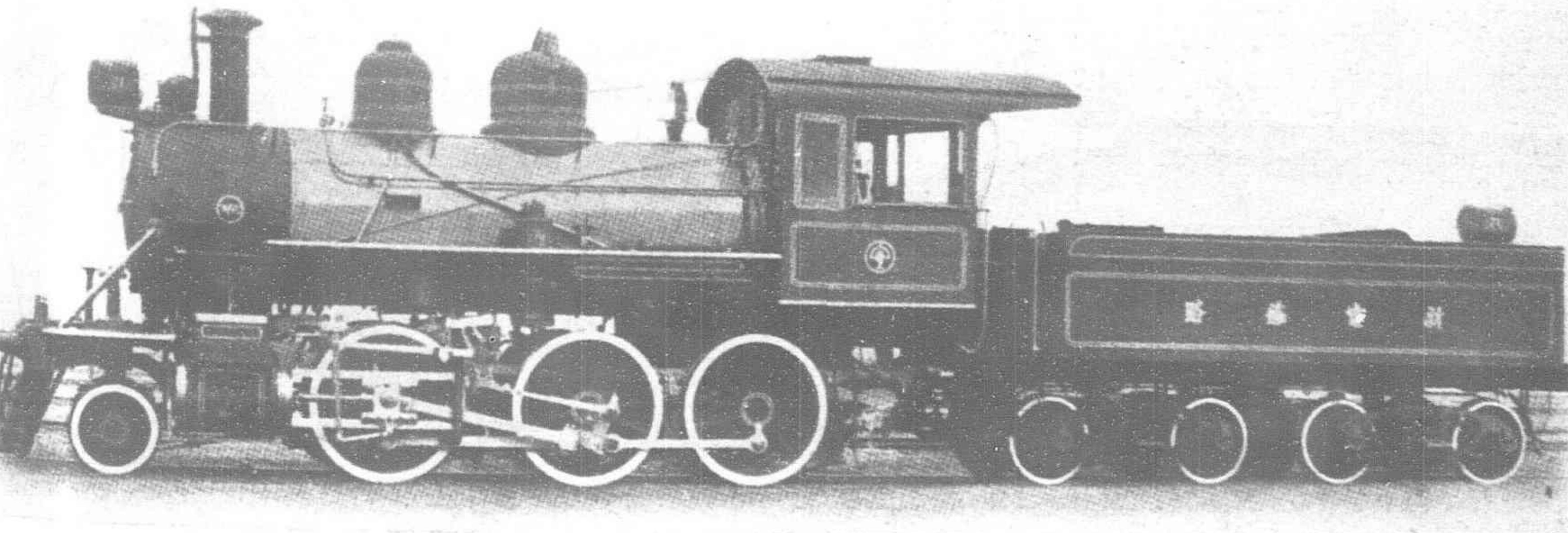
The advantages and economies which will accrue to the Sunning Railway from the new bridge, especially through longer and heavier trains and faster schedules, will be tremendous.

trips to and from Hongkong, some 100 miles distant. Junks, cargo boats and steam and Diesel launches ply from Pakkai to Canton and other important trading centers of Kwangtung Province, over the network of rivers and streams too shallow for the larger types of river steamers.

The Sunning Railway is a standard (4-ft. 8½-in.) broad gauge

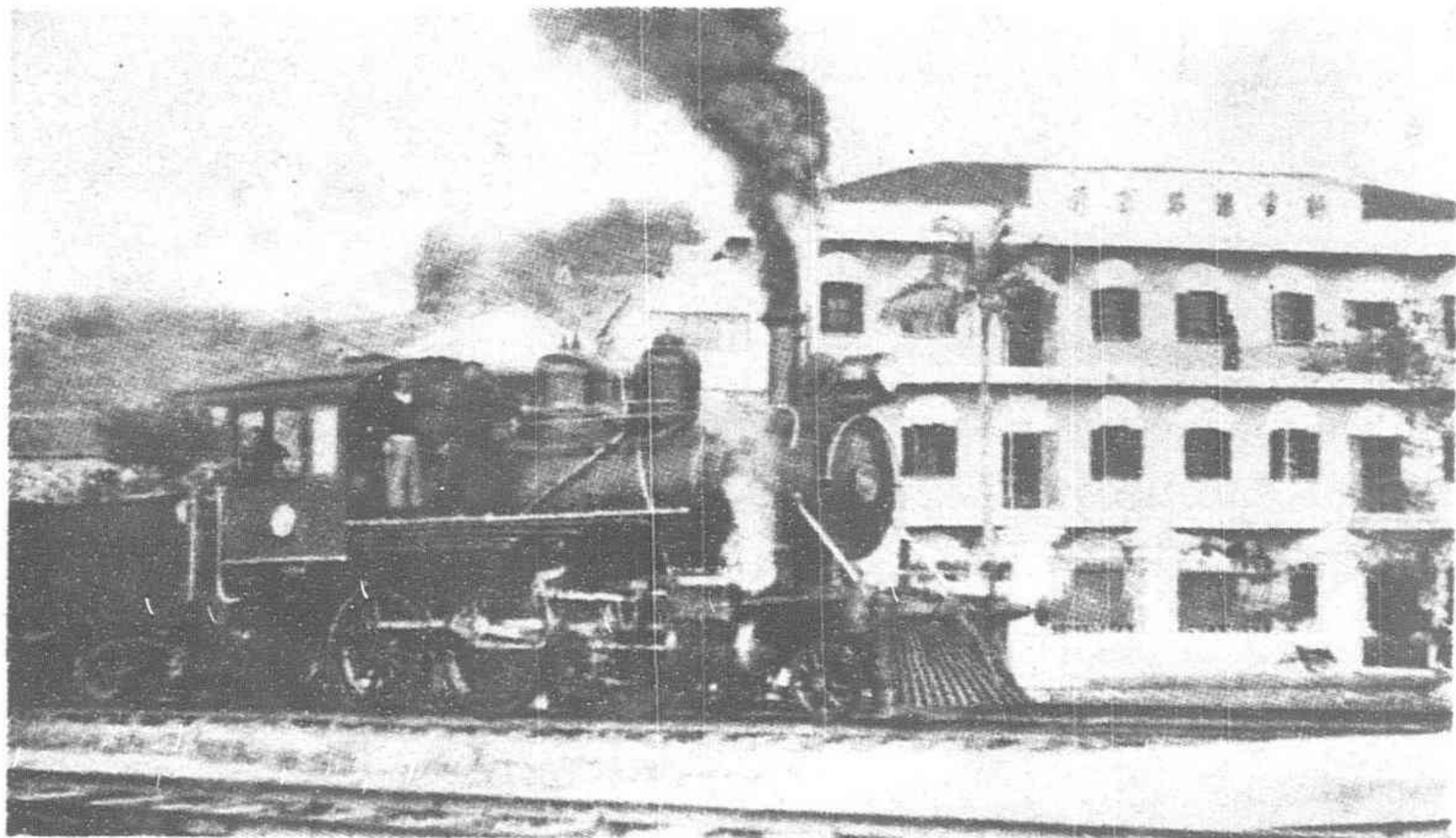
line. Along the 80 miles of main line between Towshan and Pakkai there are 35 stations, and on the branch line from Toishan to Paksha there are 11 stations. The extent to which the country is cut up with rivers and creeks is evidenced by the fact that the main line boasts 160 bridges and 189 conduits, and the branch line 53 bridges and 56 conduits.

The rolling stock to-day includes 15 locomotives, 49 passenger coaches and 100 freight cars of various types. All of its first rolling stock was purchased from the United States. A number of gasoline-engine-driven rail coaches are now used for passenger

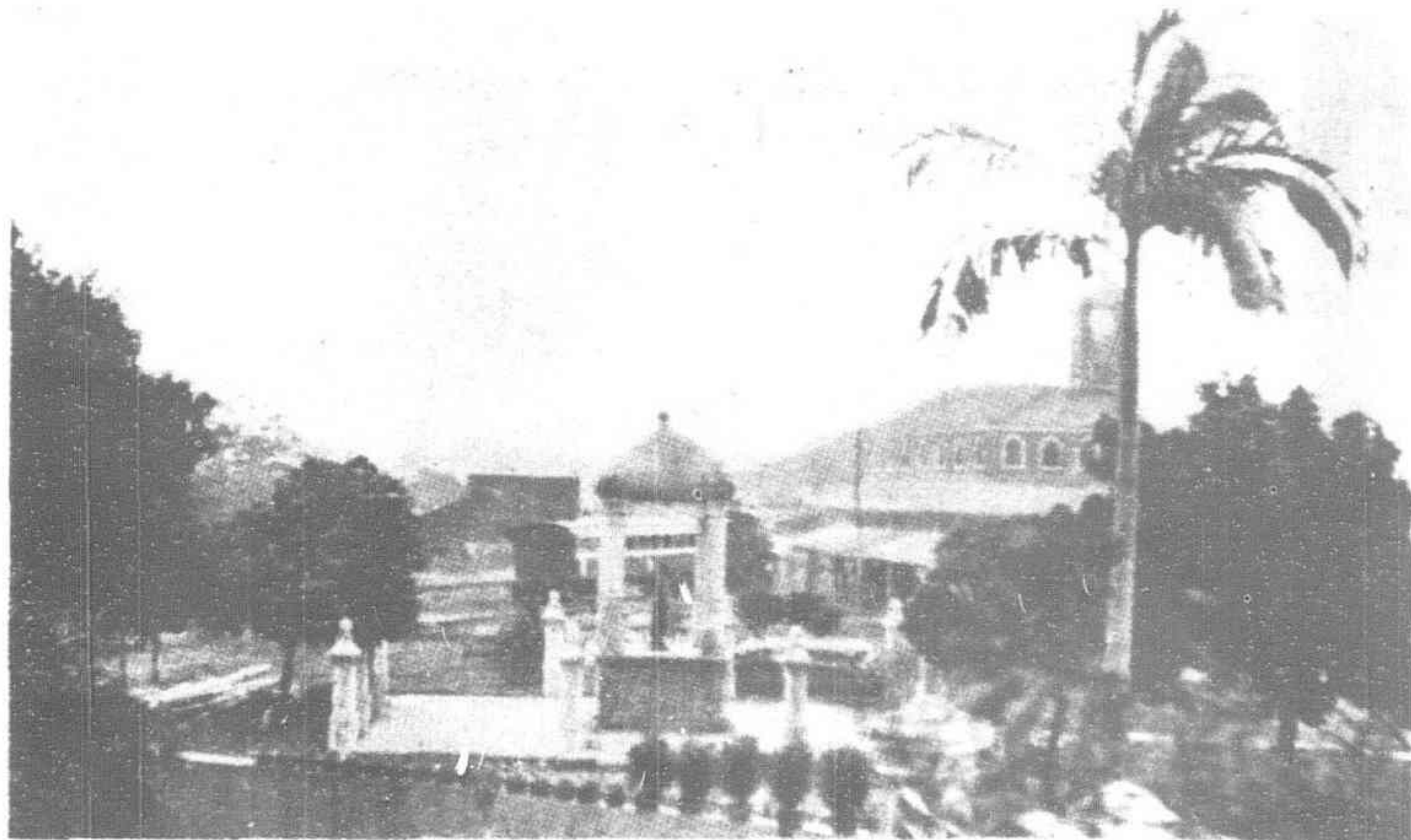


One of the Baldwin Mogul Type Locomotives completed in January, 1934, for the Sunning Railway

Track gauge ..	4-ft. 8½-in.	Drivers, diam ..	54-in.	Weight on drivers ..	85,700 lb.
Cylinders ..	16-in. by 24-in.	Heating surface ..	1,117 sq. ft.	Weight, total engine ..	99,700 lb.
Steam pressure ..	180 lb.	Grate area ..	21.1 sq. ft.	Tractive force ..	17,400 lb.



One of the Baldwin Mogul Type Locomotives at Toishan with the Administration Building of the Sunning Railway in the background



A view taken from the Balcony of the Administration Building at Toishan showing the Statue of Mr. Chin Gee Hee, the founder of the Sunning Railway

traffic between Toishan and Kung Yik. Standard motor truck chassis are used under coach bodies built in the railway workshops.

The first two Baldwin locomotives for this railway were of the Mogul (2-6-0) type and were built in 1907. Since that time, seven duplicates of these first Moguls have been supplied. Four saddle-tank, 0-4-0 type locomotives were built between the years 1907 and 1909. In 1928, two Moguls, larger and more powerful than those previously built, brought the total number of Baldwin locomotives on this road up to fifteen. In 1933 Baldwin was given the order for two duplicates of these latter Moguls and they were completed in January, 1934.

These latest locomotives have firebox plates and water space staybolts of copper; Walschaerts valve gear; and Westinghouse air brakes on all driving and tender wheels. Sunbeam electric headlight equipment is provided, including the Type SA Turbo Generator having a capacity of 1,500 watts at 32-volts. This provides current for train lighting as well as for headlights and cab lights.

The Sunning Railway is one of the few privately owned and operated railways of China. The directors are elected by its 23,000 shareholders, most of the latter being residents or natives

of the Sunning District who take an active interest in the affairs of the railway. The Head Office is at Toishan, which is also the seat of the government of this district.

The directors and chief executives of the railway at the time of writing are :

Mr. Chan Lee Chuen	..	..	..	..	..	Director
Mr. Chan Hung Leung	..	..	..	..	..	Director
Mr. Chan Hung Fo ..	..	..	..	..	..	Director
Mr. Chan Wu Chung	..	..	..	..	..	Director
Mr. Ma Chui Chew	..	..	..	..	..	Director
Mr. Ma Chi Lung ..	..	..	..	..	..	Director
Mr. Tan Wei Ting ..	..	..	..	..	..	Director
Mr. Wong Fong Chow	..	..	..	..	..	Director
Mr. Chen Yu Ping ..	..	..	..	..	..	General Manager
Mr. Ma Chow Yu ..	..	..	..	..	..	Assistant General Manager

Passenger traffic contributes considerably more than freight to the revenue of the Sunning Railway. The development of its freight business has been limited by the competition of cheap water transportation. Approximately 1,750,000 passengers and 100,000 tons of freight are carried each year.

China to Build More Cotton Mills

More work for British manufacturers of textile machinery and factory equipment may result if plans now under consideration for the further industrialization of South China are approved by the Provincial Government of Kwangtung.

In foreshadowing this development a correspondent in Hong-kong states that as a direct result of the new Customs Duties, Chinese domestic productions have made rapid strides forward in recent months, especially at Canton where Shanghai-made cloth is now being sold to the exclusion of almost everything else. A visit to Canton reveals a busy-trade in cotton prints, dyed cottons, colored woven goods and grey and white shirtings, all emanating from Shanghai mills which have been glad to find an outlet for their productions in South China following the loss of the important Manchurian market. In the shops at Canton there are pattern-books from Chinese factories bearing anti-foreign slogans and urging buyers to support "Home Industries."

According to our correspondent the Canton Government has already placed orders with a firm of Lancashire textile machinists for equipment for two cotton spinning and weaving mills and a small woollen mill and it is reported that negotiations are proceeding for the equipment of a third cotton mill.

Inquiries in Lancashire this week have failed to confirm the report of business having already been done, but *Textile Mercury* learned from several independent sources that quotations had been asked for and in one instance negotiations are actively proceeding.

According to the Chinese Cotton Millowners' Association (Shanghai) there are now 133 cotton mills in China, employing

257,000 workers. Of the total number of mills 89 are Chinese owned, 41 Japanese, and three British. The rate of growth of spindles and looms in Chinese and Japanese mills in China are shown in the following table :—

		No. of Spindles		No. of Looms	
		Chinese Mills	Japanese Mills	Chinese Mills	Japanese Mills
1919	..	889,000	333,000	—	—
1920	..	1,775,000	812,000	7,740	1,486
1921	..	2,124,000	849,000	10,645	2,986
1922	..	2,221,000	1,071,000	12,459	3,969
1924	..	2,176,000	1,218,000	13,689	5,925
1925	..	2,049,000	1,332,000	13,371	7,205
1927	..	2,099,000	1,383,000	13,459	13,981
1928	..	2,182,000	1,515,000	16,787	10,896
1929	..	2,386,000	1,652,000	—	—
1930	..	2,499,000	1,821,000	15,955	11,467
1931	..	2,730,000	2,003,000	20,599	19,306
1932	..	2,910,000	2,096,000	21,559	18,289

The *Chinese Economic Bulletin* announces that in view of the large quantities of cotton yarn imported annually from India into Canton, the Kwangtung Provincial Government authorities are contemplating the establishment of another large cotton mill in Canton. All machinery and equipments are, according to the report, to be purchased from Great Britain.—*Textile Mercury*.

The Use of Nickel Alloy Steels in Japan

By JAMES A. RABBITT, Adviser to the Japan Nickel Information Bureau

Foreword By Dr. SABURO WATANABE, President Japanese Special Steel Company

(Continued from April, 1934)

IN addition to the foregoing, the separation of the cementite from the iron-nickel-carbon solution does not take place as readily as it does in a plain iron-carbon solution. Therefore, the pearlite areas are left larger and less clearly defined than in plain carbon steel. The effect of nickel upon the critical ranges, compared with carbon steel, is given in Fig. 27.

The critical point ranges for nickel steel occur at considerably lower temperatures than for carbon steel, and when the nickel content has been increased to 25 per cent these ranges are lowered below atmospheric temperatures, thus making the alloy steels of the higher nickel content air hardening.

Structural Changes Due to Nickel

The aforementioned progressive lowering of temperatures in the transformation ranges according to the nickel content, forms a basis for the classification of nickel steels, which are divided into the following three classes:*

Pearlitic Nickel Steels are those in which the nickel and carbon contents are such that, when slowly cooled from a high temperature they will consist in whole or in part of pearlite. In these steels the nickel ranges from 0 to 10 per cent and follows inversely the percentage of carbon, which theoretically ranges from 0 to 1.60 per cent. The pearlitic steels containing less than 4 per cent nickel are of most importance commercially.

Martensitic Nickel Steels: In these steels the nickel and carbon contents are high enough to lower the critical ranges to such a degree that only a partial transformation from austenite to pearlite occurs even on slow cooling. In these steels the nickel contents range from 10 per cent to 25 per cent with the carbon varying.

Austenitic Nickel Steels: Above 25 per cent the influence of the nickel is so great that the transformation range is lowered to atmospheric tem-

perature and the steel is always austenitic regardless of the carbon content.

In Fig. 28, Guillet shows the composition ranges of the aforementioned groups of nickel steel. The theory upon which these three groups change is that upon the introduction of a third element into a given carbon steel, the steel remains at first pearlitic in structure, but as the content of the third element is increased, the steel becomes martensitic, and by a still further increase of the third element, it becomes austenitic or cementitic depending upon the chemical action and the alloying powers of the third element added with respect to carbon and iron. By keeping the amount of the third element constant, the same transformations may be effected by raising the carbon content. According to Johnson,† the rule for the alloying of iron with other elements is as follows:—

"If iron be combined by fusion with notable quantities of an element whose melting point is very much below that of iron, the tendency is to produce a metal of inferior physical properties, but if iron be combined with an element whose melting point is nearly that or higher than that of iron, then the tendency is to produce a metal of superior physical properties."

Nickel meets this requirement and many others by:

- (a) Refining the grain structure and improving the homogeneity of the resulting alloy.
- (b) Increasing the strength of the alloy.
- (c) Increasing the toughness of the alloy, thus rendering it more resistant to both fatigue and shock.
- (d) Adding a fair degree of hardness which emphasizes all of the aforementioned qualities.
- (e) Providing exceptionally high ratios of ductility to strength.

* "The Making, Shaping and Treating of Steel," Carnegie Steel Company, Bureau of Instruction, Page 722.

† Johnson, C. M., "Chemical Analysis of Special Steels," IV Ed., P. IX, 1930.

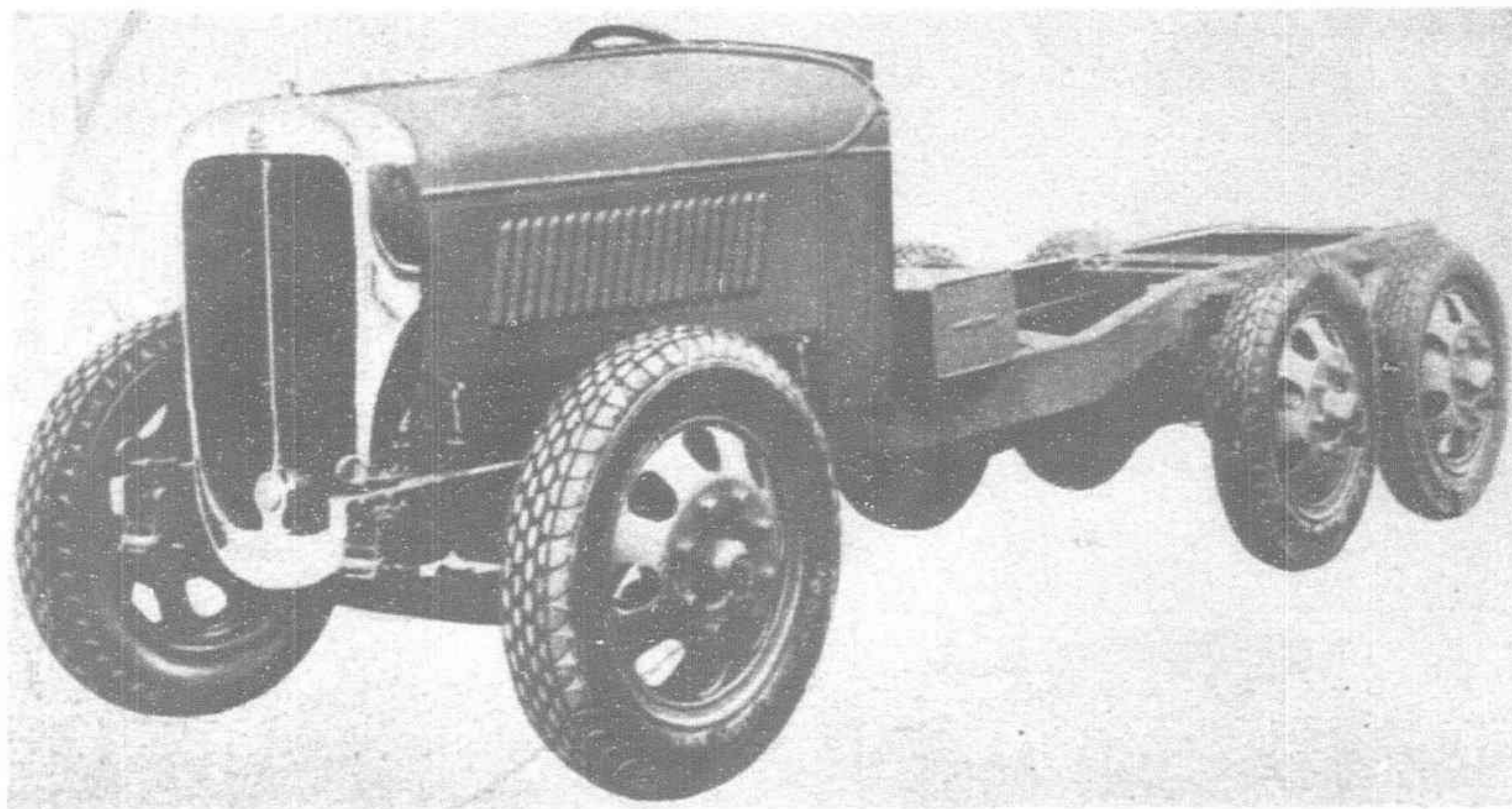


Fig. 14.—Truck Chassis Manufactured by Nippon Automobile Engineering Co., K.K. Cast Nickel Steel used in Brake Drum and special Large Sprocket Wheel. Nickel Case Hardened Steel, Piston Rod, Cam Shaft, Spindle of Water Pump, Valve Tappet Stem, Transmission gears and shafts, Universal Fork, Differential gears, final reduction gears

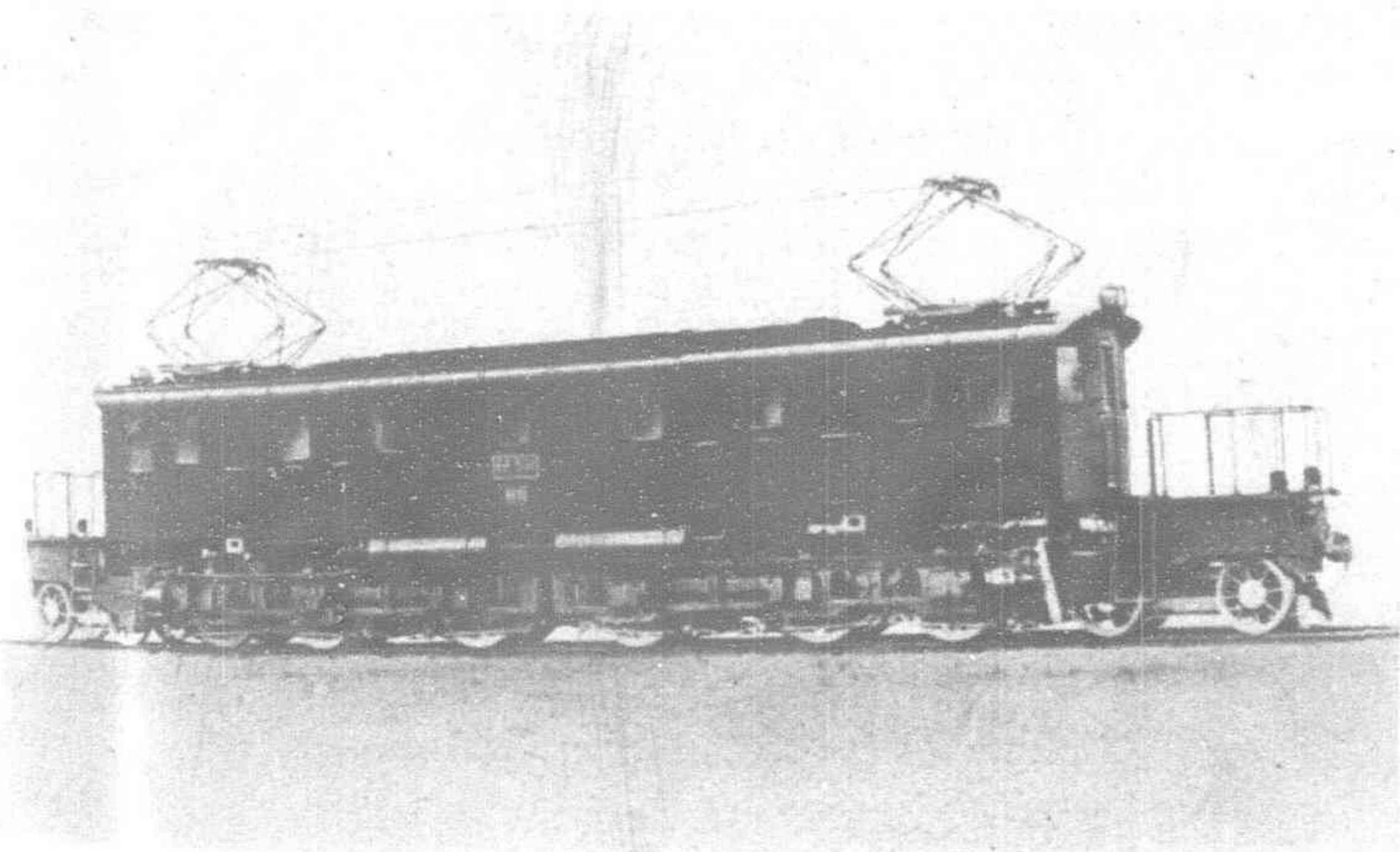


Fig. 12.—100 ton Electric Locomotive for Imperial Government Railways of Japan. Built by Hitachi Manufacturing Works & Co. All Pinions for Direct Coupled Electric Motors made of Nickel Steel

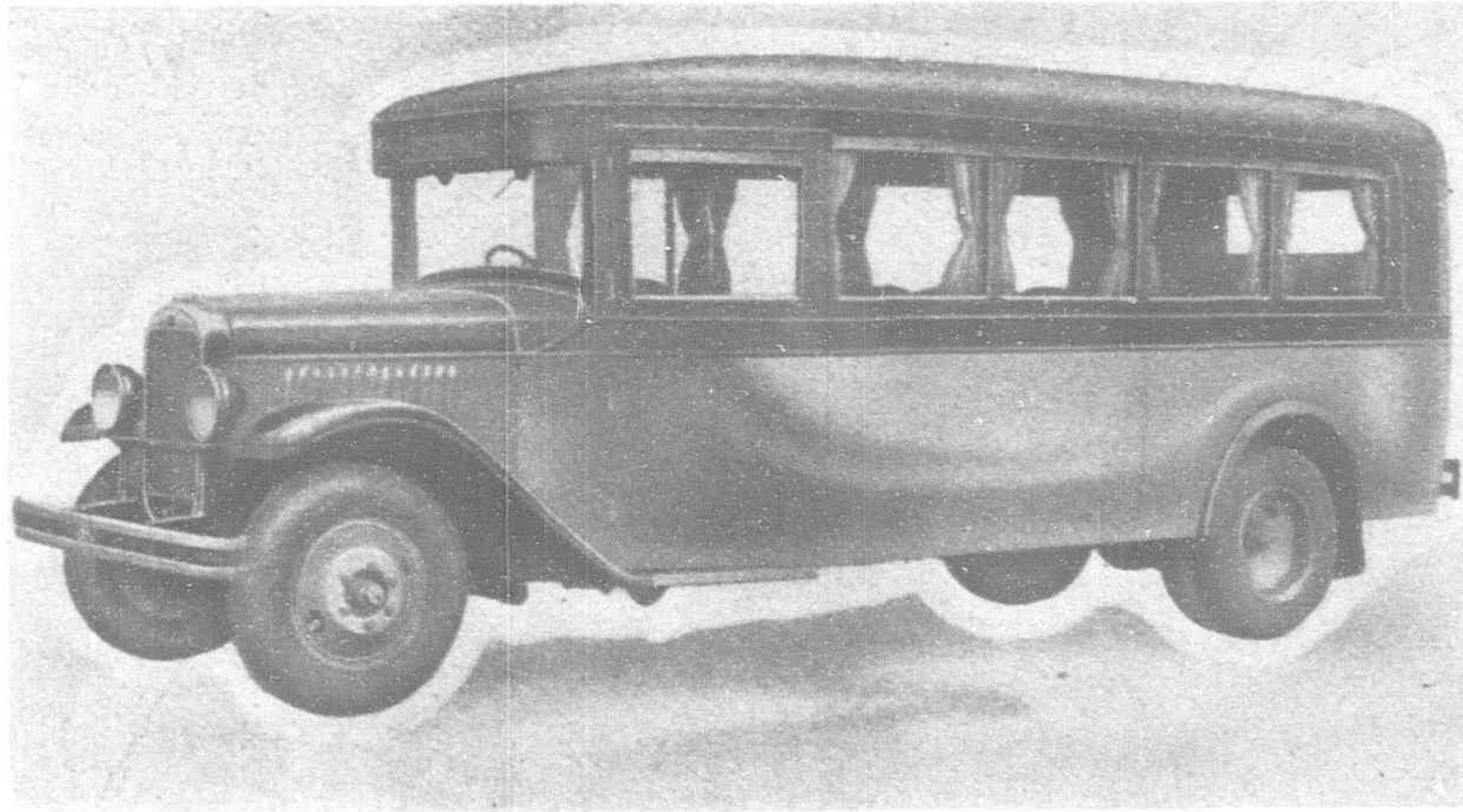


Fig. 13.—6-Cylinder 40 h.p. Bus Manufactured by Mitsubishi. Nickel-Chromium Steel used in Crank Shaft, Connecting Rods and Intake Valves. Case Hardened Steel, Front Axle

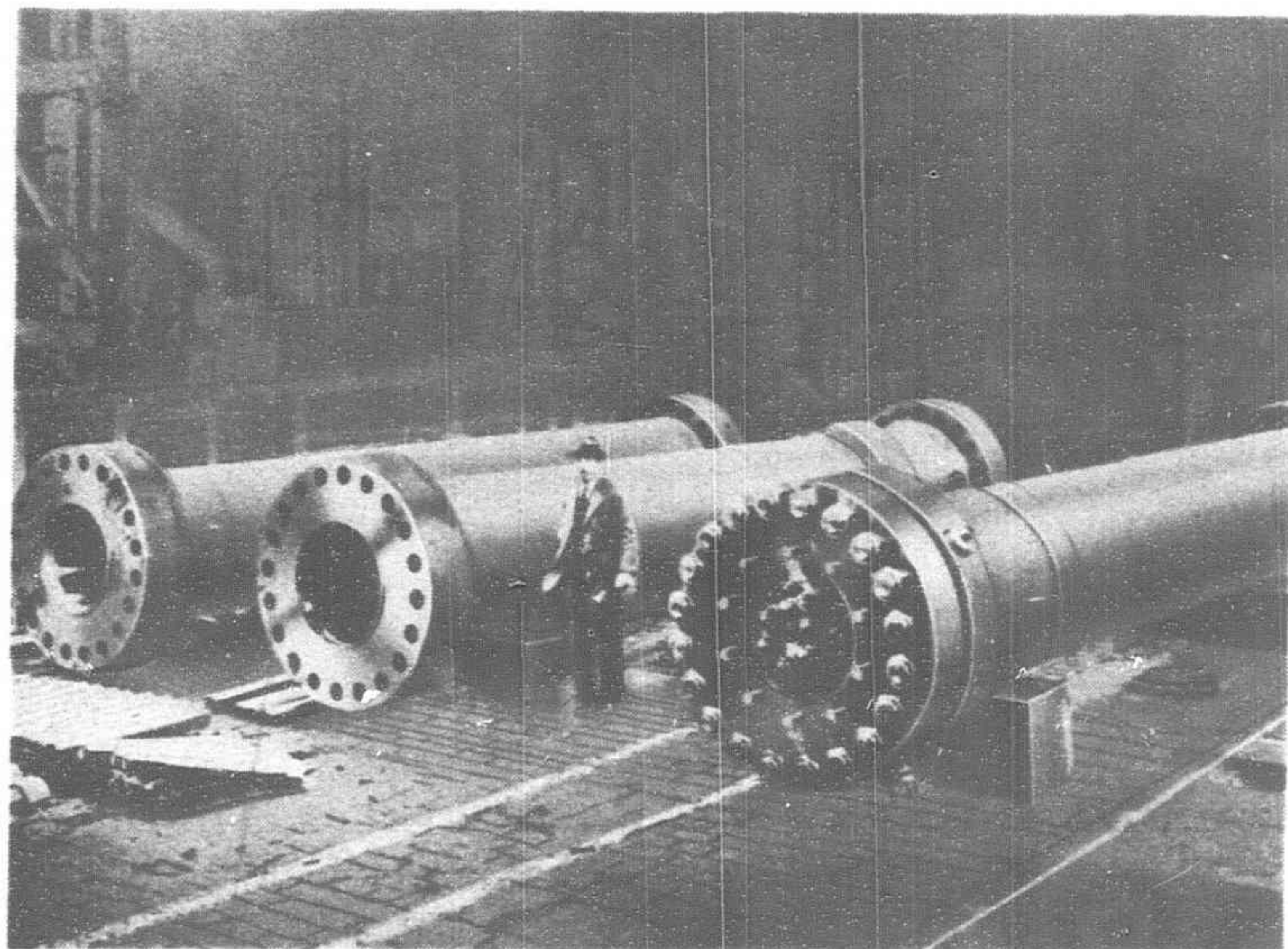


Fig. 15.—High Pressure Cylinders of Nickel-Chromium Steel for Synthesis of Ammonia in Ammonium Sulphate Industry. Manufactured by Nippon Steel Works (Muroran)

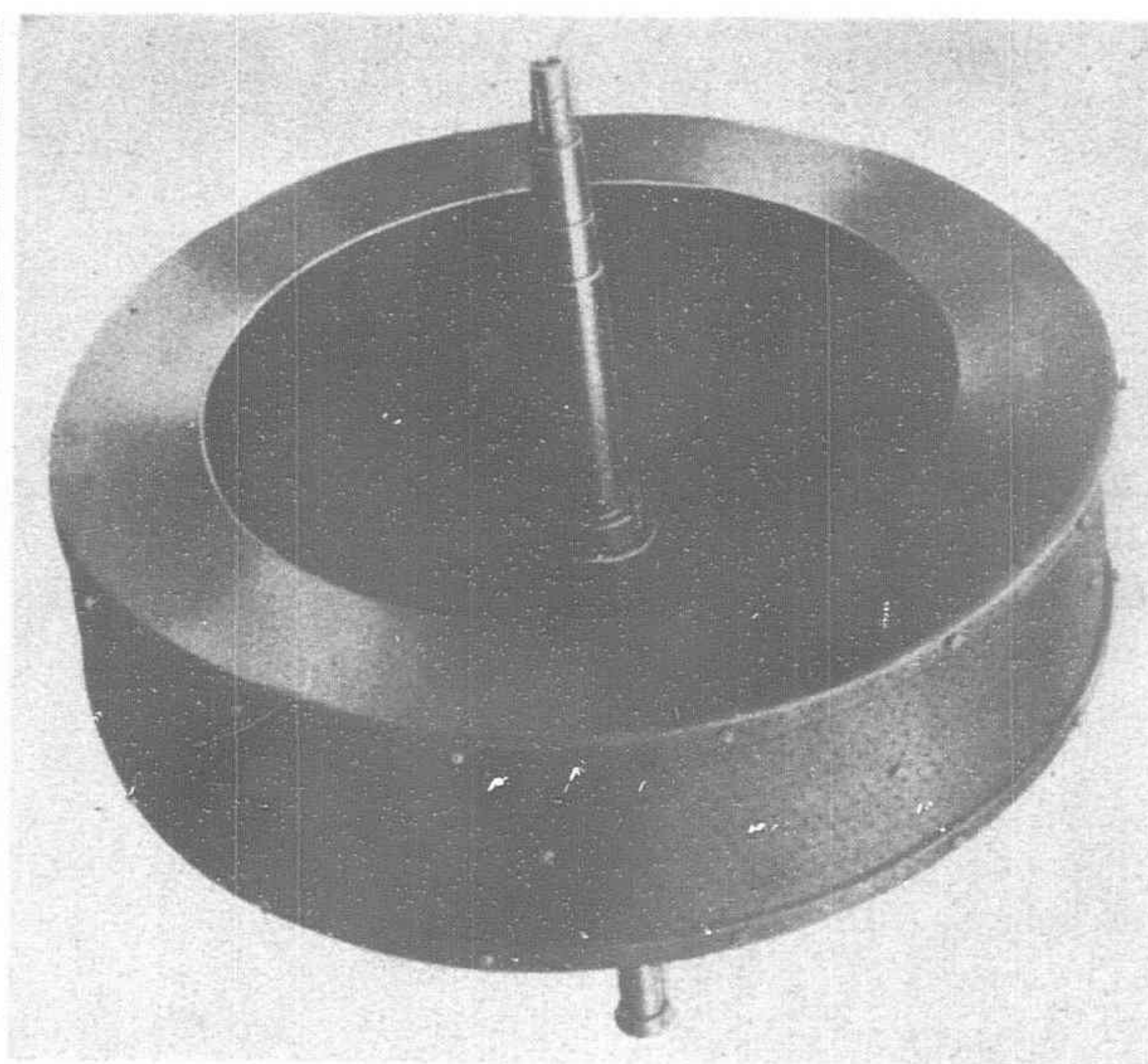


Fig. 16.—Centrifugal Extractor made by Tsukishima Co. Basket in Machine made of Nickel-Chromium Steel or Monel Metal according to requirements of users

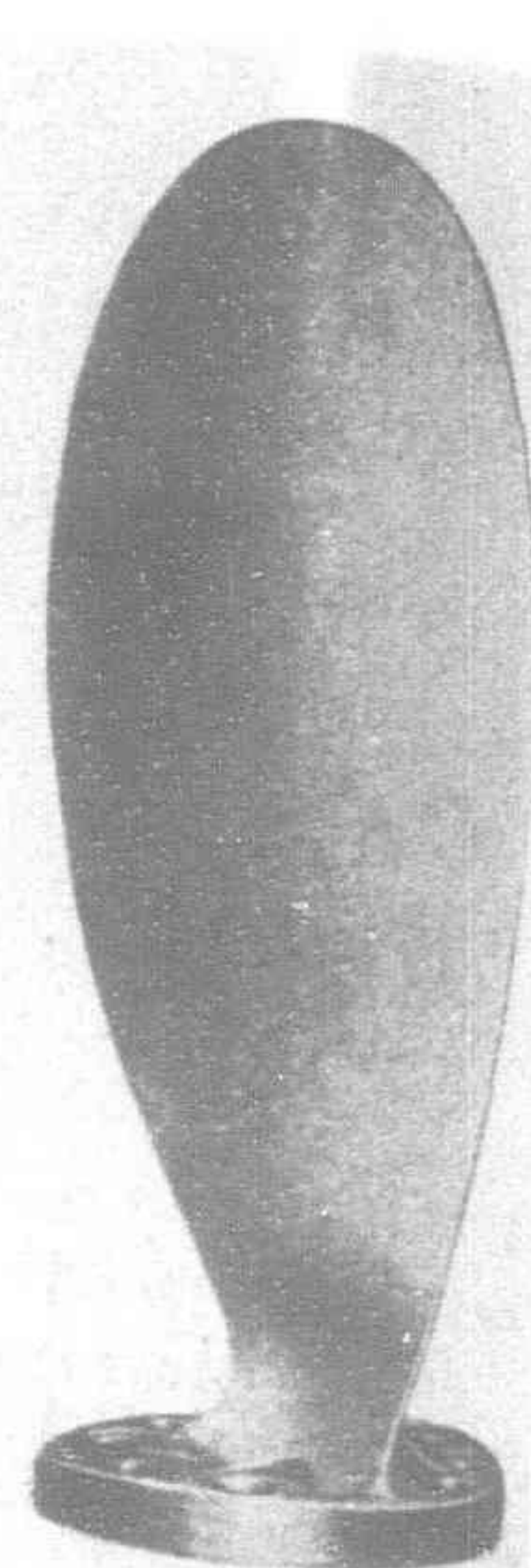


Fig. 17.—Blade of Propeller made of Nickel-Chromium Steel by Nippon Casting Co.

- (f) Increasing the resistance to corrosion.
- (g) Possessing exceptionally high heat resisting qualities.
- (h) Imparting beauty in appearance.

Before giving consideration to some of the specific applications of nickel, it will be of interest to note the trend in the use of nickel during recent years. Fig. 29 indicates a distinct advance in the consumption of nickel, but Fig. 30 shows more strikingly the upward trend in its consumption curve of steel ingots and castings. The rapid increase in the demand for nickel alloy steels may be gauged by the steel production in the U.S.A. which is usually taken as the barometer of industrial expansion. This production, between the years 1923 and 1930, increased 22.46 per cent, while the general production of alloy steels advanced during the same period 65.88 per cent.

A practical classification of the attributes of nickel alloy steels, which includes all of the "Superior Physical Properties" already mentioned may be covered by the following:

- (a) Strength and hardness with toughness.
- (b) Strength with lightness.
- (c) Resistance to wear and stress.
- (d) Quality with economy in case hardening.
- (e) Resistance to corrosion.
- (f) Heat resistance.

Strength and Hardness with Toughness

As engineering development has proceeded the tendency has been to demand higher and higher strengths, or, in other words, a higher strength per weight ratio.

It is, possible to obtain a certain added degree of strength and considerably higher hardness in the carbon steels by increasing the carbon content, but a limit is soon reached because this increase is always accompanied by a rapid fall in ductility and by an increase in brittleness. The problem to be solved, therefore, was the production of a material which combined strength or hardness with sufficient ductility and toughness. The toughness required is particularly that which resists shock, or the propagation of a crack formed by a local failure in the part. Any occurrence giving rise to a crack may not be disastrous if the crack can be prevented from spreading, but if the concentration of stress at the base of a crack cannot be resisted, then the failure of the part may take place immediately.

Various methods have been suggested for measuring the resistance of materials to shock, but in the case of steels the most generally accepted test is that known as the Impact Test, devised by Izod or the test devised by Charpy. The demand of the engineer, is in general, therefore, a steel with high strength accompanied by ductility and high impact figure. This demand has been met by the use of alloying elements in the steel, and particularly by the addition of nickel. Nickel has always been considered as being the pre-eminent alloy addition for increasing toughness, due partly

to its solution in the iron or ferrite component of the steel, and also to its refining effect on the micro-structure, together with its influence on heat-treatment.

It is possible with a nickel-containing steel to obtain a higher ductility and toughness for a given tensile strength, or, alternatively, a higher strength for a given toughness, than it is with carbon steels. Table III illustrates this point. In it are given the properties of a carbon steel which has been hardened and tempered to produce optimum values, and a nickel steel which has been heat-treated to give, in one case, a tensile strength, and in the other case a toughness, similar to that of the carbon steel.

TABLE III.—COMPARISON OF MECHANICAL PROPERTIES OF CARBON STEEL AND NICKEL STEEL

			Carbon Steel 0.3% C	3% Nickel Steel 0.3% C 3.0% Ni	
				(a)	(b)
Elastic Limit	..	.. kg/mm ²	41.0	44.0	60.0
Yield Point	..	.. "	45.0	54.0	72.0
Tensile Strength	..	.. "	66.0	66.0	83.0
Yield Ratio	..	.. %	67.0	80.0	85.0
Elongation	..	.. "	27.5	27.5	23.0
Reduction of Area	..	.. "	60.0	68.0	63.0
Izod Impact Value	..	.. kg.m.	5.8	14.5	7.0

Column (a) in Table III shows how much higher the impact figure of the nickel steel is compared with a carbon steel of an equivalent strength of 66 kg/mm². Even with a tensile strength of 83 kg/mm² (Column b) nickel steel has higher impact values with comparable values for elongation and reduction of area.

Carbon steels very rapidly become brittle as temperatures approach or pass the freezing point. Nickel steels, however, maintain their toughness at both high and low temperatures, and for this reason are widely employed for stressed parts of machines which have to work in high latitudes or in any position where the temperature is likely to be low. Nickel steels in which the composition has been properly proportioned are also being extensively used above normal temperatures.

Strength with Lightness

Weight is a factor which enters into all engineering problems. Particularly is this the case when movement takes place and, since all power problems involve movement, their solution must necessarily take the question of weight or mass into account. Although by proper balance and design the effects of weight may be minimized, wherever reciprocating or centrifugal motion is encountered, the incidence of stress produced by the reversal of movement or the centrifugal force set up makes a reduction of weight generally desirable.

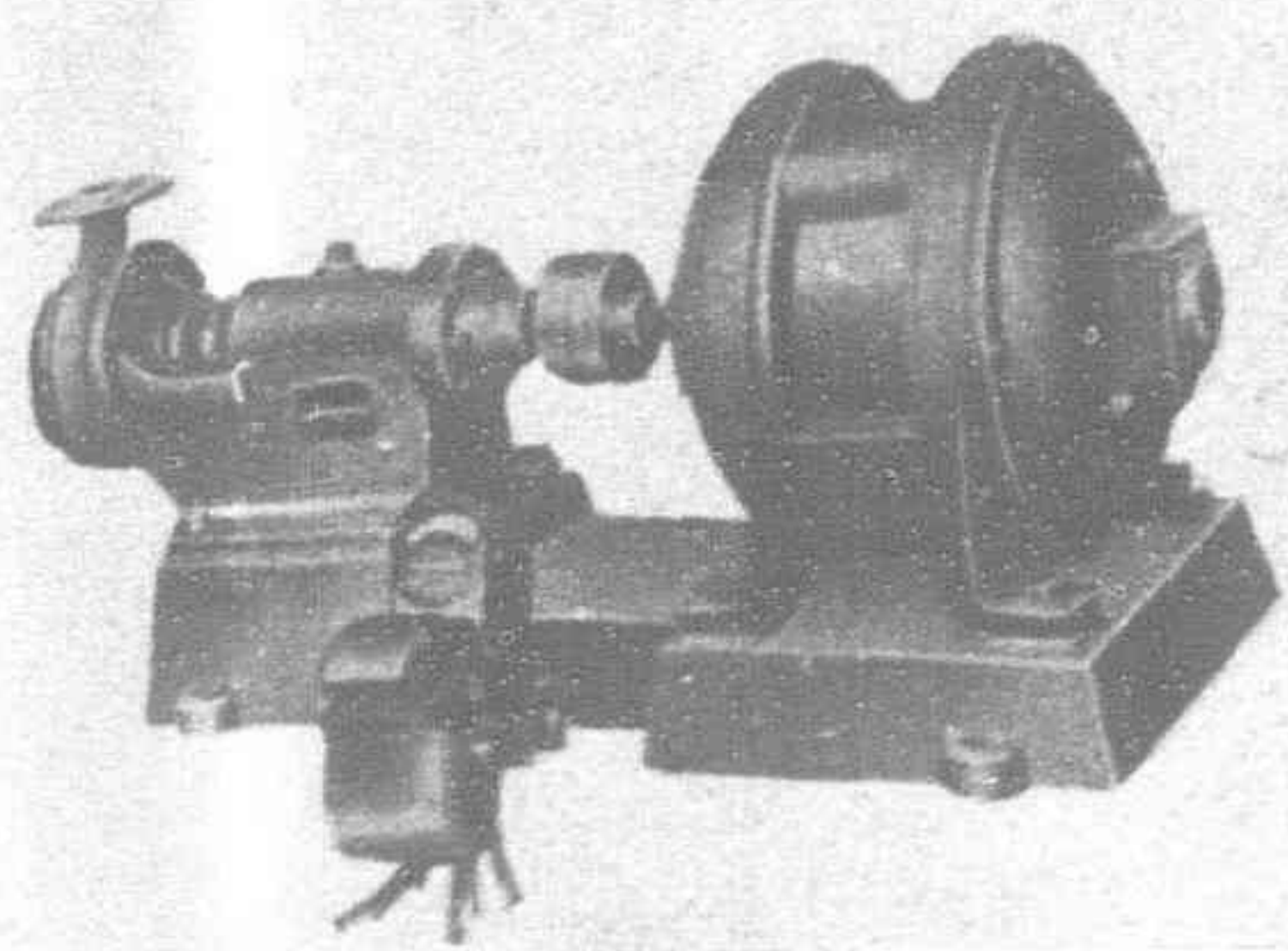


Fig. 18.—Centrifugal Pump made of Stainless Steel by Nippon Casting Co. (Tsurumi)

When the machine drives a vehicle, weight is of even greater importance since it is necessary to carry the weight of the power unit as well as that of the vehicle and its load. The lower the weight per unit of power produced, the greater is the load that can be drawn. When the vehicle leaves the ground, weight becomes of the greatest importance and advances in aeronau-

tics have been largely based on this factor. The use of alloys of low specific gravity and the cutting down of the section of the metal used have been valuable in saving weight. In both cases, however, the factor of strength must be considered. A joint consideration of strength and weight, and the strength/weight ratio has become of increasing importance in engineering development.

Although remarkable advances have been made in the metallurgy of light alloys, and although many excellent materials are now available in these light alloys, the metals which have the best strength/weight ratio are still the better alloy steels. The large air liners, flying boats and amazingly speedy fighting machines have been rendered possible only by the extensive utilization of alloys particularly of the high tensile nickel-containing alloy steels.

The rapid development from the days when an engine had a weight of several pounds (1 pound=0.456 kg.) per horse-power, to the engine which has less than one pound per horse-power, may be largely credited to the high strength and reliability which nickel alloy steels provide. The high strength/weight ratio of the high tensile nickel-chromium steels has been recognized by their wider use in aeronautics in the structure of the aeroplane. By the use of heat-treated thin strip which is fabricated into hollow shapes especially designed to withstand the stresses imposed, an all-metal structure of very low weight with exceptional strength can be built up.

The automotive use of nickel alloy steels is lowering the weight of engine and chassis so that the load carried or drawn can be increased. Axle load restrictions make it impossible to increase the total weight, and it is for this reason that materials of the highest strength/weight ratio must be employed in order that the maximum pay load can be attained.

Resistance to Wear

Wear is a subject of interest to all engineers. When they eliminate it their resources in the matter of design are enormously increased and their expenditure on replacements greatly reduced. At first glance it would seem that for most wearing purposes the hardest possible material would be the best. There are, however, many instances where a softer material, as measured by our usual methods of hardness determination, gives better service than one of excessive hardness. A certain degree of toughness is generally necessary. Extreme hardness with the possibility of the breaking off, through brittleness, of even extremely small particles, may result in the breakdown of oil films which in turn results in the local production of high temperatures and considerable wear.

As an example, the extreme punishment which the average automobile gear box undergoes results in the oil film being continually broken and, unless the steels used have suitable properties, wear soon takes place and noise and loss of power develop. It is for this reason that nickel steels, with or without case-hardening, are now most generally used for the gears in automobile transmissions. For similar reasons they are employed in various other parts of the chassis where the abrasive action of road dirt also produces wear. These properties of nickel steels make their use imperative for gears in other mechanical transmission systems and also for shafts and other moving parts where rubbing action may take place.

Where lubrication conditions are difficult, as in press tools, nickel steels extend the life of tools by several times that which is possible with ordinary carbon steels. When no lubrication is possible the problem of wear-resistance becomes even more acute. Nickel alloy steels are proving of value wherever dry abrasion occurs. In the handling of such abrasive materials as rock, sand and gravel in pulverizers or dredgers, materials are required which not only are sufficiently hard to withstand wear, but which also have a degree of toughness sufficient to withstand the shocks to which the parts are continually subjected. For such purposes special nickel-chromium-molybdenum steels are being employed, since they can be heat-treated to provide the necessary combination of high yield point, tensile strength, hardness and resistance to shock.

A case of a minor use in this connection, is the employment of alloy steels for the blades of shovels and other tools employed at quarries and similar places. It has been found more economical to employ the somewhat more expensive nickel-chromium steels for shovel blades owing to the longer life they give under these abrasive conditions.

Tramway crossings form another instance in which a combination of wear resistance and toughness is required and, in this case, cast nickel-chromium steels are giving excellent service. This type of steel also stands up satisfactorily to the "Thermit" welding process by eliminating cracks. In percussion tools, the life of the tool is dependent upon its ability to retain a sharp edge when being driven against, or through, solid metal. Hence toughness is required in combination with surface hardness. By the adoption of a special 3 per cent nickel steel for such purposes as cold chisels, boiler sets, etc., heat-treated in such a way that, although the tool is soft enough to be dressed with a file, it develops in service an extremely hard cutting edge which is maintained for very lengthy periods. It has been found possible by the use of nickel steel to cut down the number of tools used in a particular shop from eighteen per man per year to almost one tool per man per year.

A wide range of compositions, depending upon the relative importance of resistance to wear, may be used. In order to provide the necessary high shock and wear-resisting qualities required in the steel gearing for a cement plant, a nickel-chromium-molybdenum steel was selected. The large gear which weighs 2,540 kg. The following chemical composition is typical of this steel:—

C	0.3%
Mn	0.8%
Ni	3.0%
Cr	0.7%
Mo	0.3%

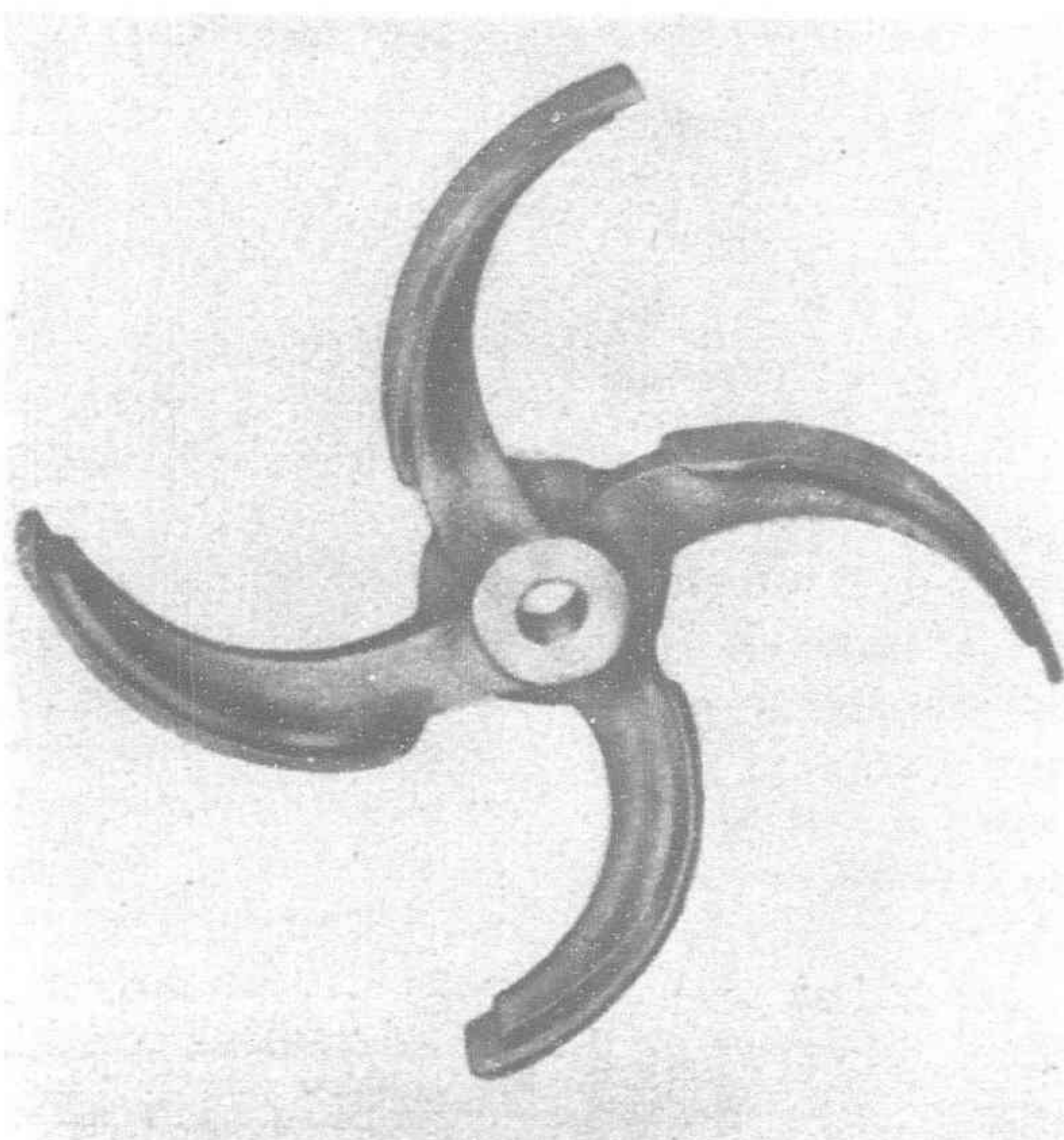


Fig. 19.—Impeller of Nickel-Chromium Steel Castings for Sand Pump manufactured by Kansai Denki Seikoshu

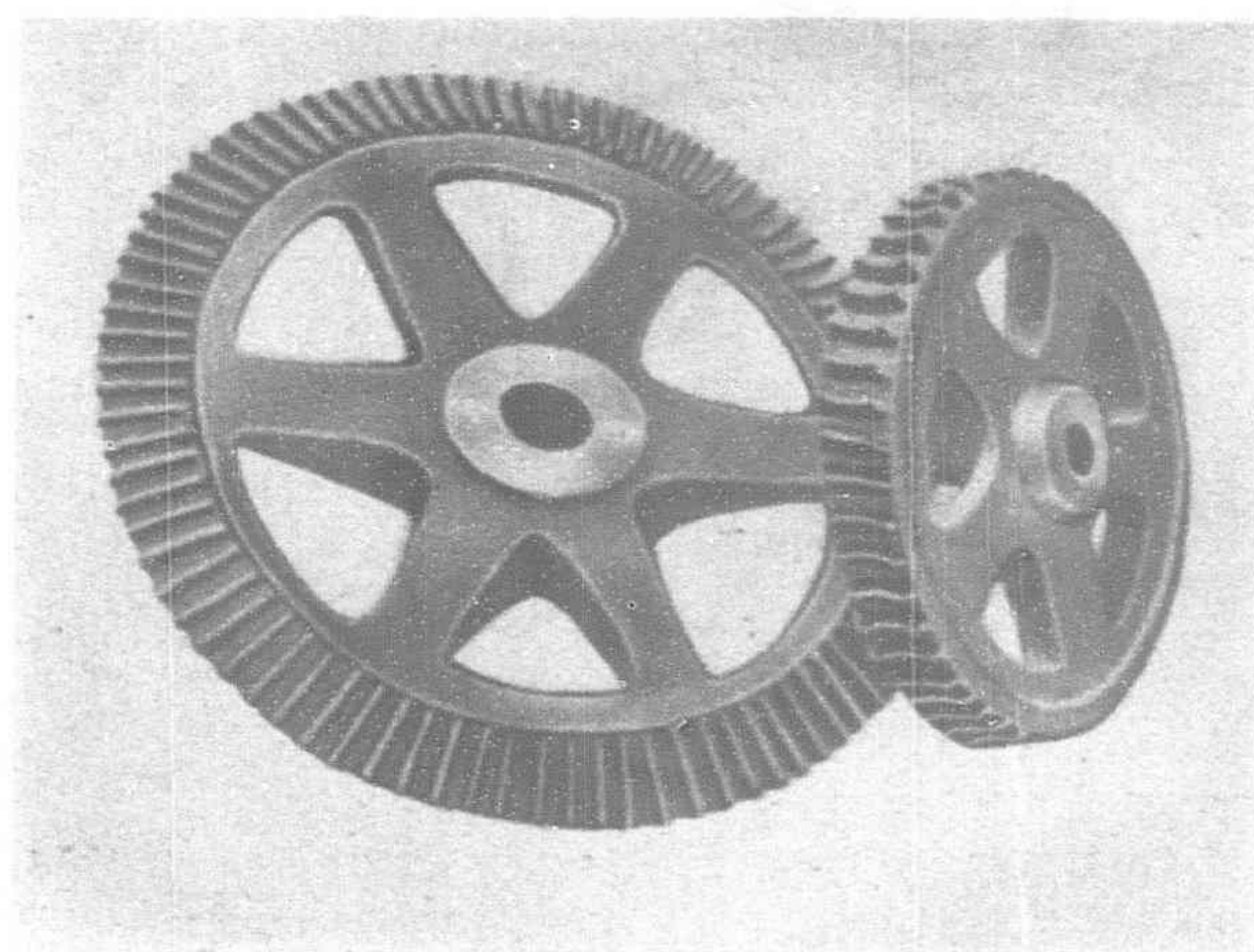


Fig. 20.—Worm and Wheel Castings of Nickel-Chromium Steel for Sand Pump manufactured by Kansai Denki Seikoshu

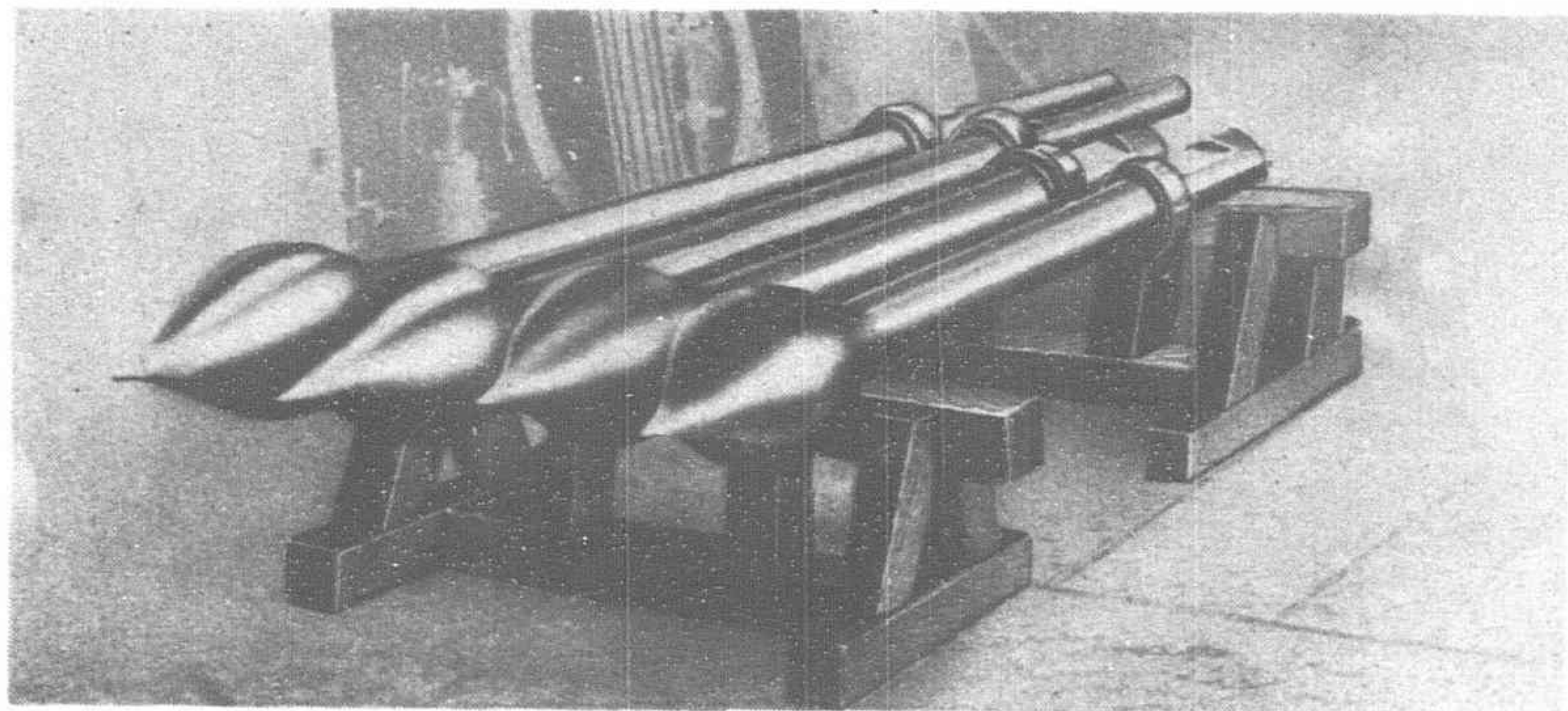


Fig. 21.—Nozzles and Nozzle Chips made of Nickel-Chromium Steel for Pelton Wheel by Dengyosha & Co., Tokyo

After annealing at 870°C, reheating to 850°C and air-cooling, then reheating to 600°C and cooling in air, the following tensile properties are typical:—

Yield Point	..	..	..	..	82 kg/mm ²
Maximum Stress	..	..	..	..	96 kg/mm ²
Elongation	..	..	..	..	12 per cent
Reduction of Area	..	..	..	..	13 per cent
Izod Impact Value	..	..	..	..	2.9 kg. m.

Quality with Economy in Case-Hardening

Reference has been made to the difficulty of combining in one alloy a high hardness or strength with high toughness, and it was shown how, by the judicious use of nickel and a suitable heat-treatment, this combination was possible. Where the need is principally for extreme hardness on the surface of a component or on just a part of the surface, the case-hardening method is used for combining hardness with toughness. This method employs a steel with a low carbon content. The carbon content of the surface or parts of the surface is increased by a carburizing operation, and the whole part is heat-treated so as to develop the highest possible hardness in the carburized portions with toughness in the core. In the making of any case-hardened part there are a number of operations involved, each of which has its effect on the ultimate cost.

In the first place the component has to be machined to the required dimensions, and here difficulty sometimes arises with the low carbon soft steel which is necessarily employed to give the required toughness. The soft material tends to drag under the tool, resulting in imperfect surface finish. The carburizing operation is carried out by burying the part in the carburizing mixture, generally one of carbon and a carbonate, and heating the whole together at temperatures between 900° and 950°C. The result is that carbon diffuses into the steel and gives it a "case" in which the carbon content varies from about 1 per cent at the surface through to the 0.15 per cent carbon of the original steel.

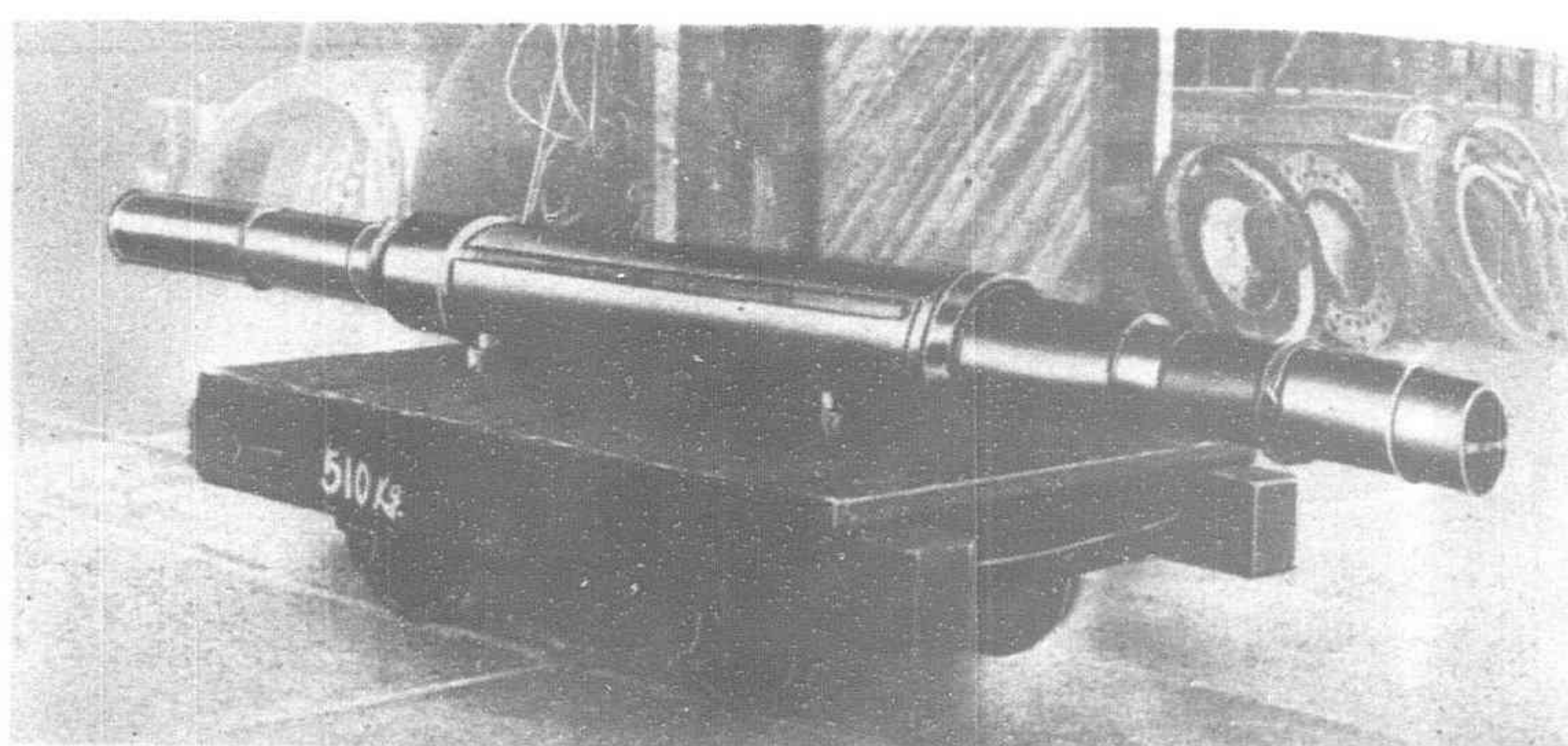


Fig. 22.—Main Shaft for 5,100 h.p. 400 mm. Six Stage Turbine Pump. Made of Nickel-Chromium Steel by Dengyosha & Co.

If it is not desired to carburize the whole of the surface, various methods are adopted for protecting those portions where the carbon content is to be maintained unchanged. Care should be taken that the amount of carbon in the surface does not exceed the maximum limit, that the depth of the case is correct, and that the transition from the highest carbon in the case to the low carbon core is gradual.

Inattention to the above details may give rise to exfoliation of the case in subsequent operations, or the production of a network of cracks during grinding, should grinding be necessary. When the carburizing operation is completed it will be seen that the component may be considered as consisting of two steels, one with low and one with high carbon, these being joined by an intermediate zone of varying carbon content. The part then has to be heat-treated to give greatest toughness to the core and highest hardness to the case. In a plain carbon steel two heat-treatments are necessary in order to insure such a condition. These heat-treatments generally are: (1) the heating of the part to 900°C and quenching in water, and (2) the reheating to about 760°C and again quenching in water. Both these treatments and quenching in water are essential for carbon steels.

Drastic quenching from a high temperature often causes either cracking or a degree of distortion which requires some surface grinding or straightening operation in order to bring the part back to its correct dimensions. However, grinding tends to diminish the case thickness, and straightening to cause minute cracks which may result in subsequent failure. Moreover, both of these operations add to the cost of production. In considering the steel to be used for a case-hardened part, the total cost as distinct from the initial cost of the steel as well as the service required should be taken into account.

Although the adding of an alloying element will increase the initial cost, this increase is off-set by the savings in factory operations, in diminution of "wasters" and the properties ultimately obtained. Of the alloying elements employed, nickel is by far the most generally utilized and its effect is noticeable in the above operations. In the first place the presence of nickel in steel insures

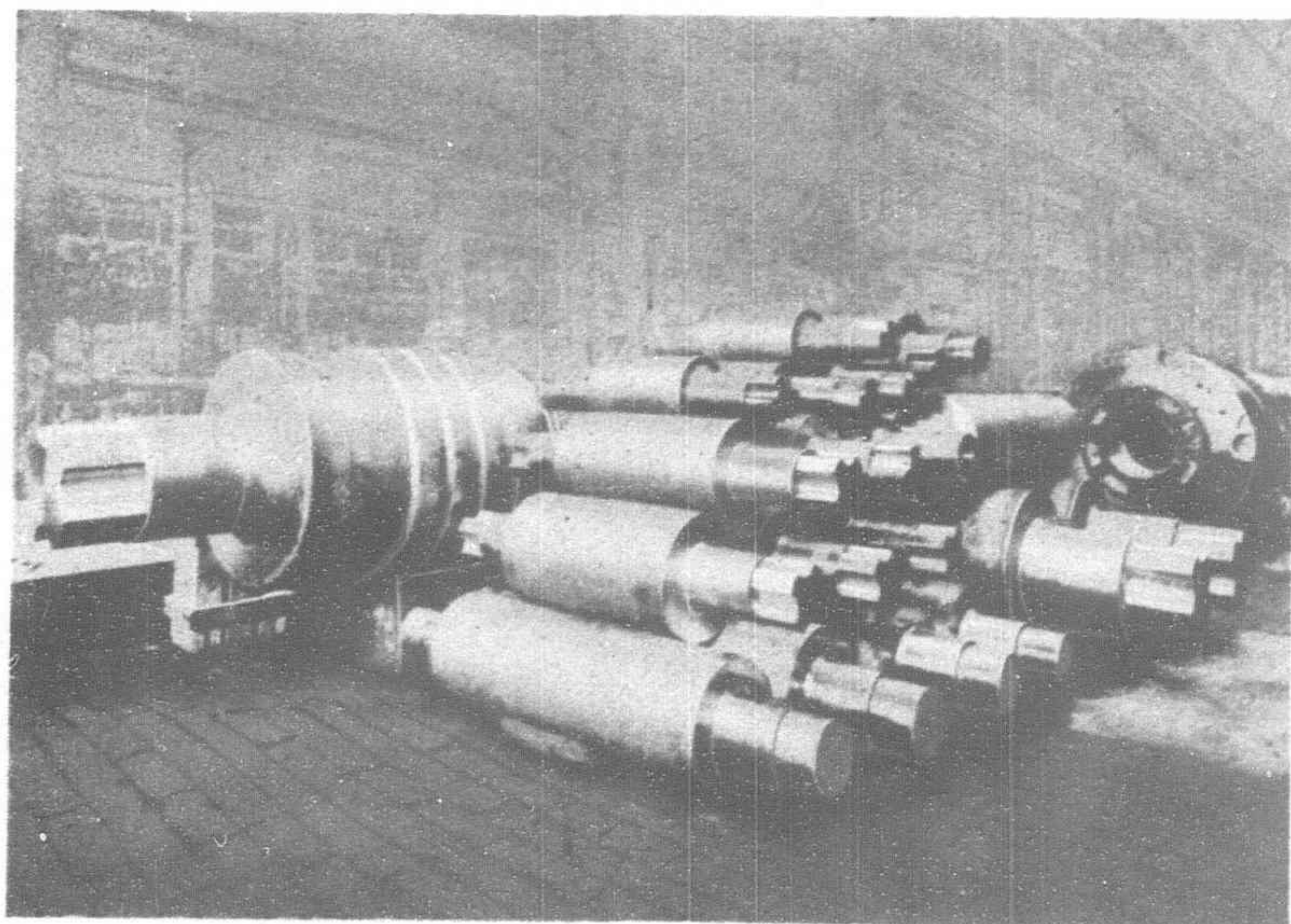


Fig. 23.—Forged Steel Rolls of Nickel-Chromium Steel made by Nippon Steel Works (Muroran)

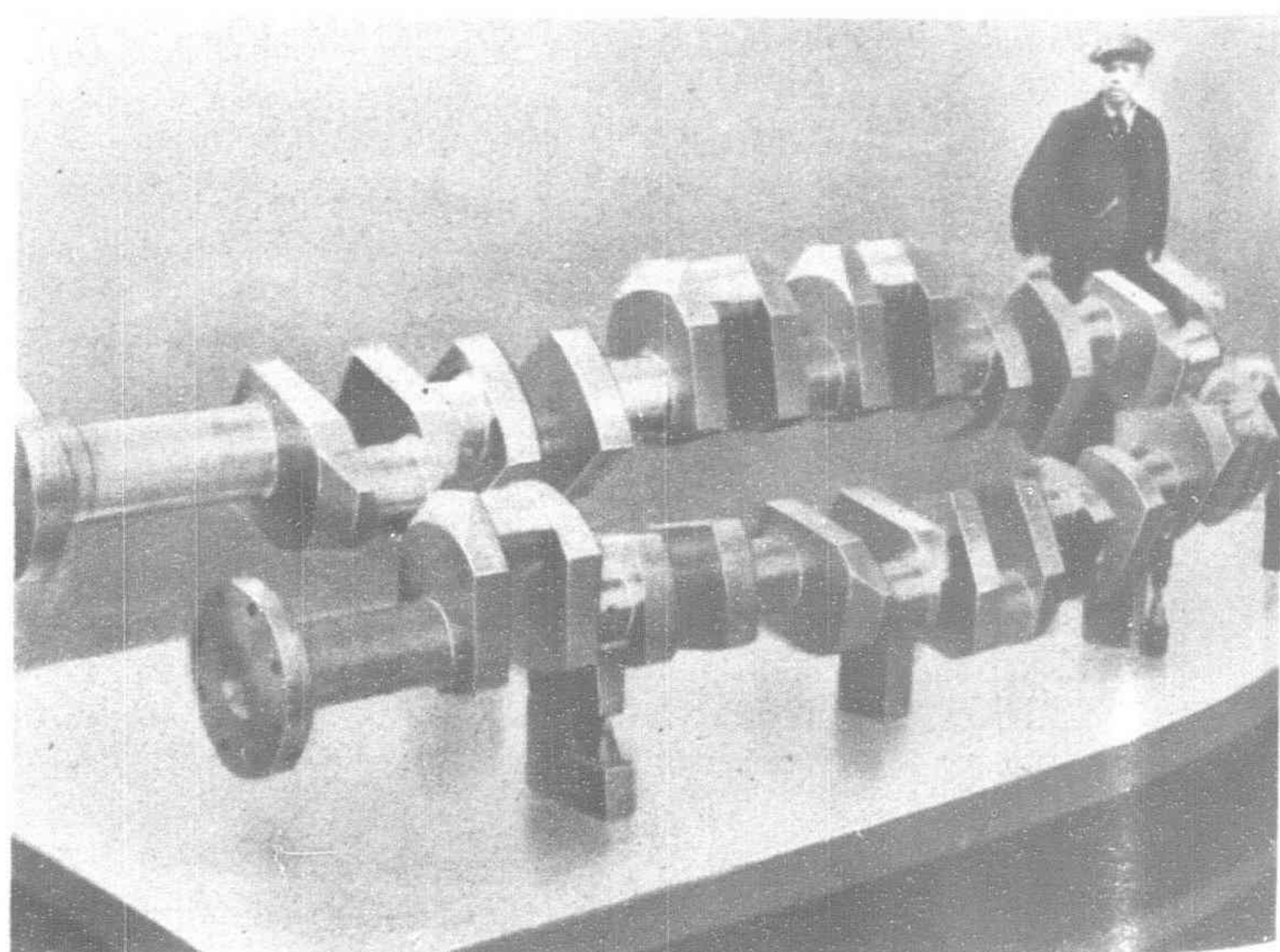


Fig. 24.—Crank Shaft of Nickel Steel made by Nippon Steel Works

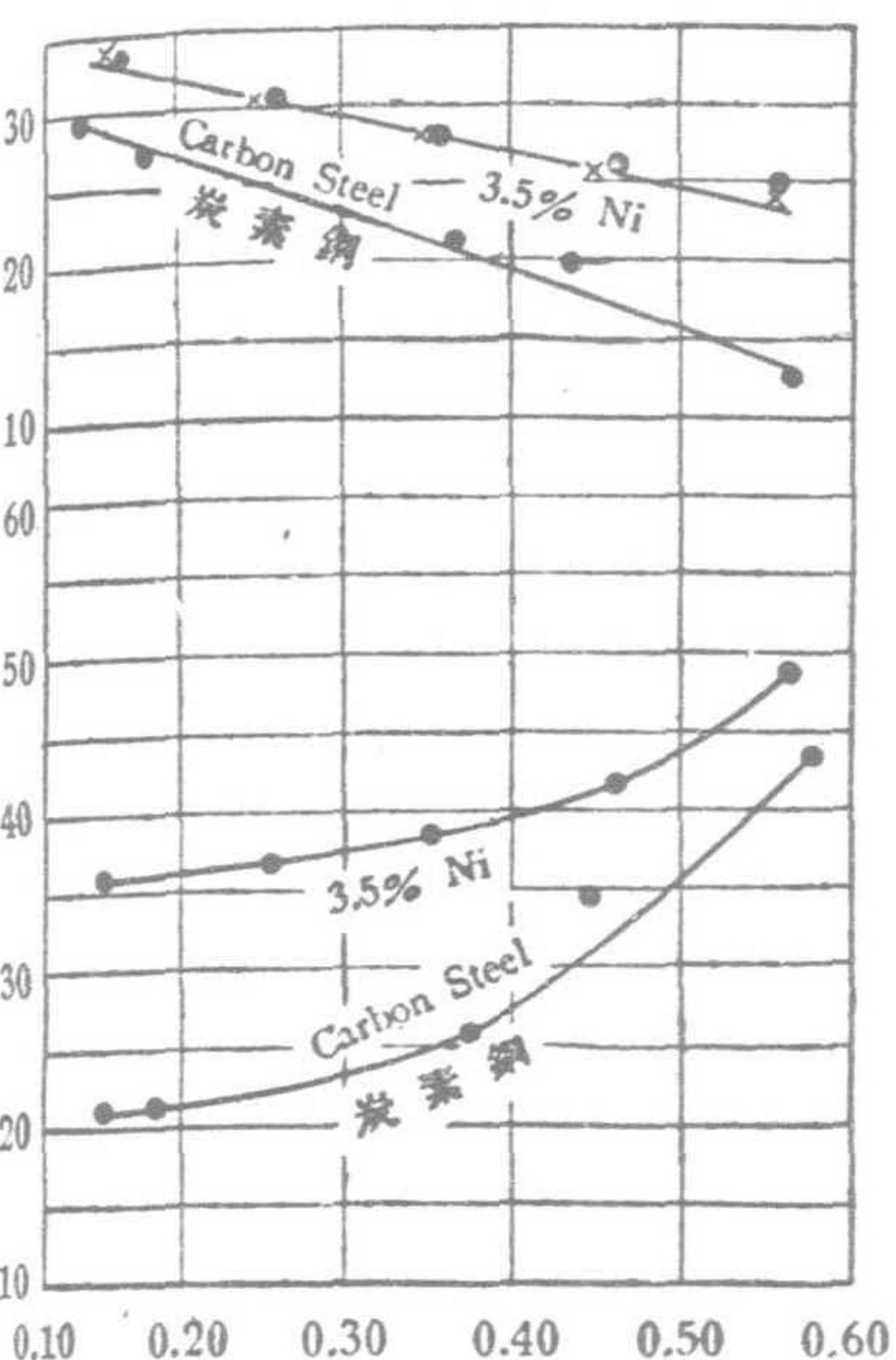


Fig. 26.—Comparison of Normalized Nickel Steel and Carbon Steel Forgings

quench from about 760°C in oil, to do all that is accomplished in a plain steel by means of two quenches in water. Not only is there a saving of one heat-treatment, a matter of some moment in regard to costs and speed of production, but the quenching treatment cut out is the one from the higher temperature and the avoidance of this, combined with the fact that the cooling can be done in oil instead of water, means that the risk of distortion and cracking is very much minimized. Thus there is saving from loss due to wasters, and in the grinding or straightening necessitated by distortion. Fifthly, at the end of the operation one has a component with properties of a considerably higher standard, particularly in regard to core toughness, than is possible without the presence of nickel.

That these advantages are widely recognized is shown by the extensive use of nickel in case-hardened steels, a use which continually grows in extent and diversity of application. Apart from the simple 3.25 per cent nickel case-hardening steel, other steels containing nickel are in common use. The 5 per cent nickel steel has been described as "one of the finest steels available to the engineer, not only for case-hardening purposes but for use in a number of other directions where resistance to shock, good mechanical properties, ease of heat-treatment and absolute reliability are required."

Resistance to Corrosion*

The development of the "stainless" type of iron alloy, in which many individuals the world over have participated during the past two decades, has reached a stage in which the interest of both engineers and producers is to a very large extent focussed upon the austenitic alloy containing about 18 per cent of chromium and 8 per cent of nickel. The group of compositions commonly described as "austenitic" should properly be split into two groups, a "marginal austenitic" group and a "stable austenitic" group.

As the designation implies, the stable alloys have qualities of permanence which the marginal alloys do not have. The popular 18 per cent chromium, 8 per cent nickel composition lies within the range of "marginal" alloys. These abstractions will become clearer by reference to Fig. 35. This diagram shows the relation between structural composition at room temperatures and chromium-nickel contents. Table IV shows the range of physical properties usually obtained from austenitic stainless steels in their different forms.

a regularity in quality and in the results of heat-treatment not observable in its absence. Secondly, nickel introduces a fineness of grain and hardness, even in the original steel, so that machining can often be carried out more speedily and with a better finish. Thirdly, although nickel has little effect on the rate of carburization, it tends to keep down excessive carbon content at the surface and gives a more uniform graduation in carbon from surface to core. Troubles from exfoliation and cracks from grinding are thus minimized. Fourthly, and most important, provided 3 per cent of nickel is present it is possible by one heat-treatment, and a

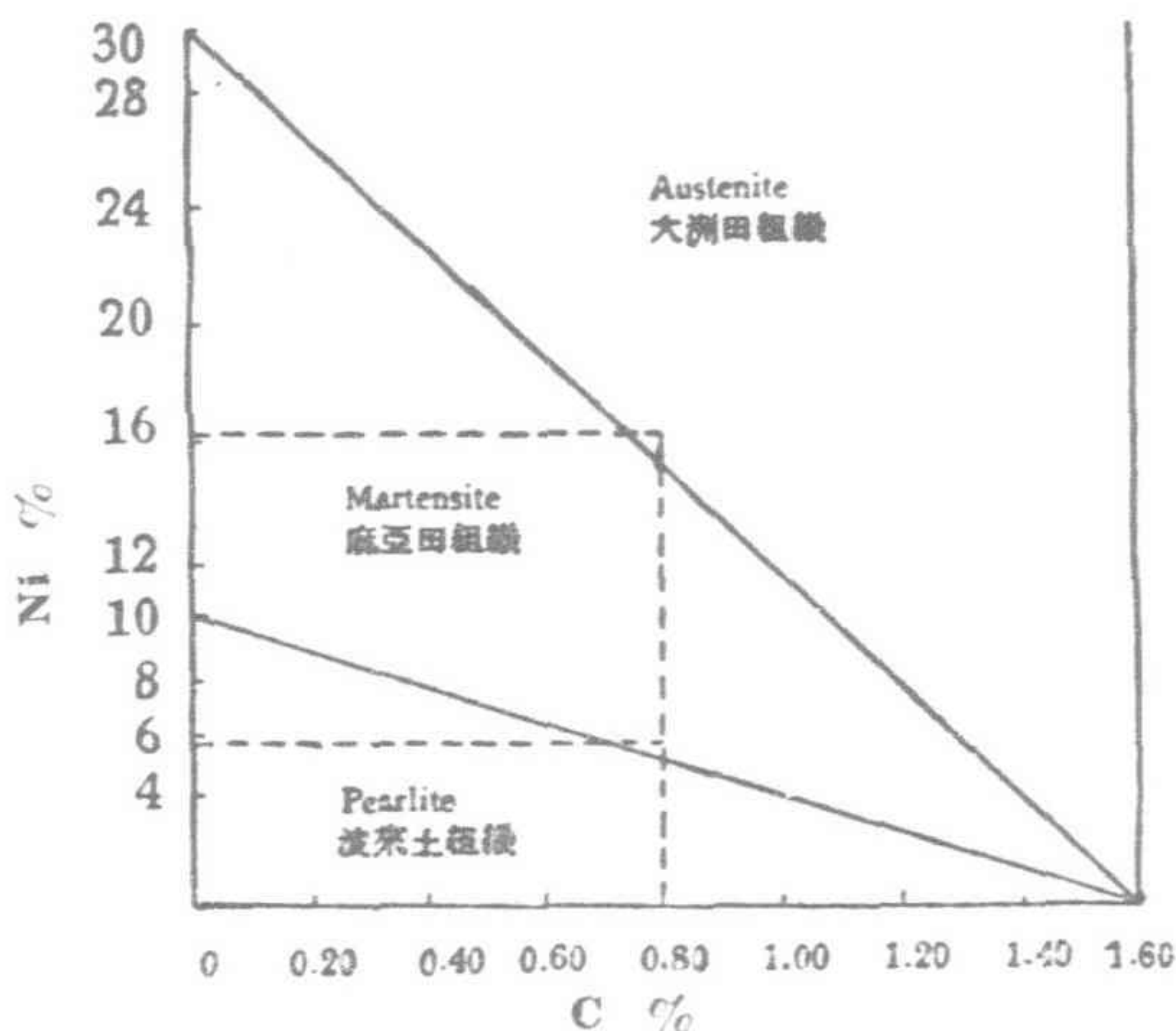


Fig. 28.—Constitutional Diagram for the Nickel Steels. (After Guillet)

must possess two practically all applications: (1) Resistance to oxidation and to scaling at elevated temperatures. (2) Retention of strength at elevated temperatures. Other factors of importance, depending on the type of application for which the material is required, must be considered. For

*Technical Information B-27: "Austenitic Stainless Steels," Japan Nickel Information Bureau.

†Pilling, N. B., and Ackerman, D.E., Institute of Metals Division, A.I.M.E., 1929, p. 248.

TABLE IV.

Condition	Proof Stress kg/mm ²	Max. Stress kg/mm ²	Elonga- tion %	Reduction of Area %	Izod impact kg.m.
Fully Softened ..	19-40	55-87	45-70	45-75	13.5-15.9
Bright Drawn Bar .	40-71	79-102	30-50	35-60	6.9-13.8
Cold Drawn Strip..	55-95	87-110	10-40	—	—
Cold Drawn Wire..	—	143-174	—	—	—
Castings ..	19-40	55-79	10-20	—	—

The usefulness of the nickel-chromium steels is inseparably associated with their corrosion-resisting properties, and any discussion of physical qualities cannot well neglect the chemical characteristics. The problems of corrosion are usually very complex. However, as a guide to the major consequences of change in chromium and nickel content, the action of two different classes of corrosive agents, namely, sulphuric and nitric acids, should be considered.

Fig. 36 shows the result of nickel and chromium contents† on the corrosion rate of a nickel-chromium steel in air-saturated dilute sulphuric acid. It appears that in order to realize the highest resistance to this type of corrosive agent, a nickel content in excess of about 13 per cent is necessary, this percentage being the same for chromium contents at least up to 20 per cent. Fig. 37 shows the effect of nickel and chromium content on the corrosion rate of nickel-chromium steel in a typical oxidizing agent, dilute nitric acid. In this case, the resistance to attack depends almost entirely upon chromium content, at least down to iron content of about 60 per cent.

The ease of shaping and the resistance to corrosion have been the two main factors in the rapid success of 18/8 steel. In addition might be mentioned the possibility of easy welding. This steel should be of an austenitic condition, quenched, in order that it may possess the remarkable qualities which make it of value. The high coefficient of thermal expansion of the metal necessitates certain precautions, if it is part of a whole made up of elements in different metals. Care must also be taken against tensions or deformations due to variations of temperature, particularly in the case of rigidly welded sections.

Heat Resistance

In order that a metal or alloy may be suitable for use at elevated temperatures it must possess two important properties which are essential in

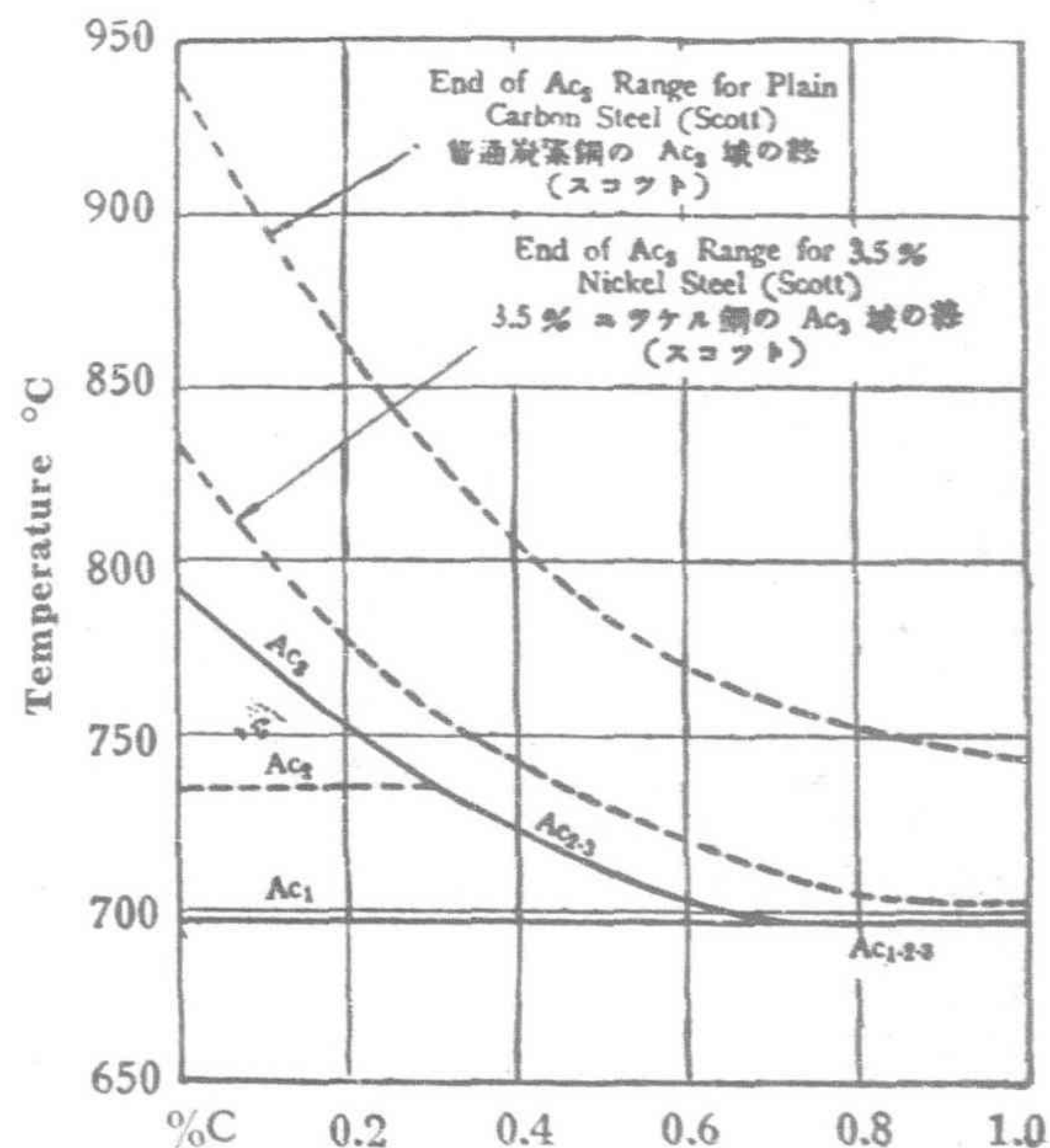


Fig. 27.—Effect of Nickel upon Critical Ranges. Solid lines represent temperatures of maximum intensity

electrical purposes, the specific resistance and temperature coefficients are important. For constructional units, coefficients of expansion must be considered. For many furnace applications, resistance to penetration by-products of combustion is required. There is no sharp dividing line as regards chemical composition between certain heat-resisting nickel-chromium iron alloys and the heat-resisting nickel-chromium steels.

These heat-resisting steels are now used for a wide variety of conditions entailing heat and corrosion under both static and dynamic stresses. They are very suitable for use at temperatures in the range of 600° to 850°C, when their life is practically indefinite. They also give very satisfactory results at higher temperatures, as only little scaling occurs, and the slight scale formed by oxidation is very adherent and protects the underlying metal. Although the essential constituents are nickel and chromium, the actual compositions for heat-resisting steels cover a fairly wide range. The chromium content may vary from 10 to 30 per cent, and the nickel from 7 to 35 per cent, while in certain special cases the latter may be as high as 60 per cent. Small percentages of silicon and tungsten are also generally present in varying amounts up to 3 and 6 per cent, respectively.

The heat-resisting nickel-chromium steels are in the "austenitic" condition, i.e., no matter from what temperature they are quenched, there is no possibility of any hardening whatever taking place. This is a decided advantage when the steels are used for parts which are subjected to alternate heating and rapid cooling, as no hardening, and consequently no brittleness, will occur. Since there is no critical point with its accompanying volume change, the tendency of an ordinary steel to warp and crack under repeated rapid coolings is considerably minimized.

A higher tensile steel can only be achieved by cold working, which varies with the size of the part being worked. However, heat-treatment after forging has a softening effect and, though the hardness is scarcely affected up to about 800°C., the effect of higher temperatures is to produce increasing softening, the maximum softness being obtained by air cooling from a temperature of about 1,050° to 1,150°C. The heat-resisting steels possess a combination of high strength and ductility coupled with excellent resistance to scaling and corrosive gases at elevated temperatures. They are available in any of the usual forms and can be fabricated by the standard methods adopted for ordinary structural steels.

Uses of Nickel Alloy Steels

Nickel alloy steels are widely used in motor-cars and airplanes. The chief parts of motor-cars which are largely made of nickel or nickel-chromium steel are transmission and rear-axle shafts, steering knuckles, stressed bolts, connecting rods, crank shafts, front axles, etc., etc. The nickel content of such steels varies from about 2 to 5 per cent and that of chromium from 0.5 to 2.0 per cent. An important development in the automobile in-

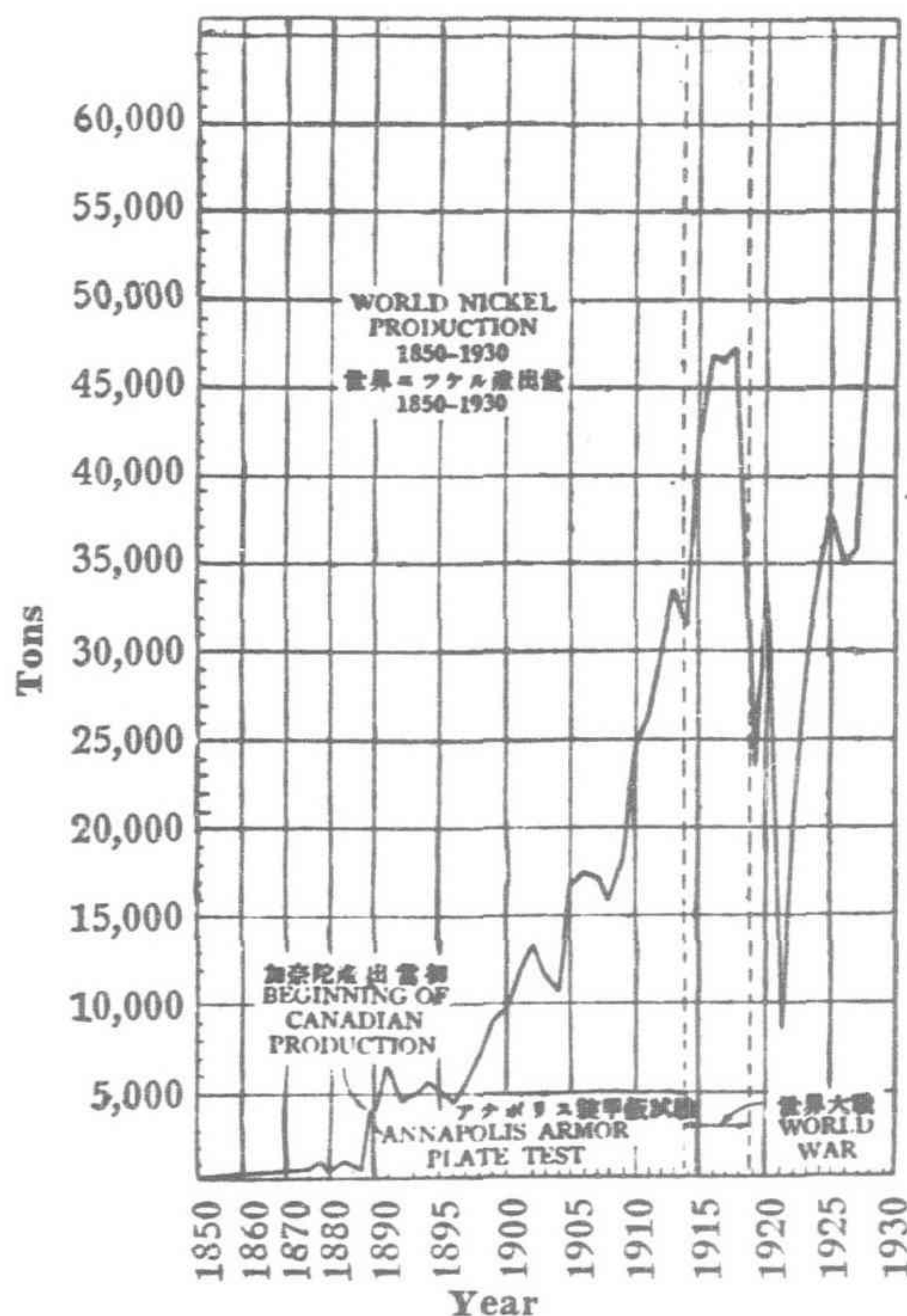


Fig. 29

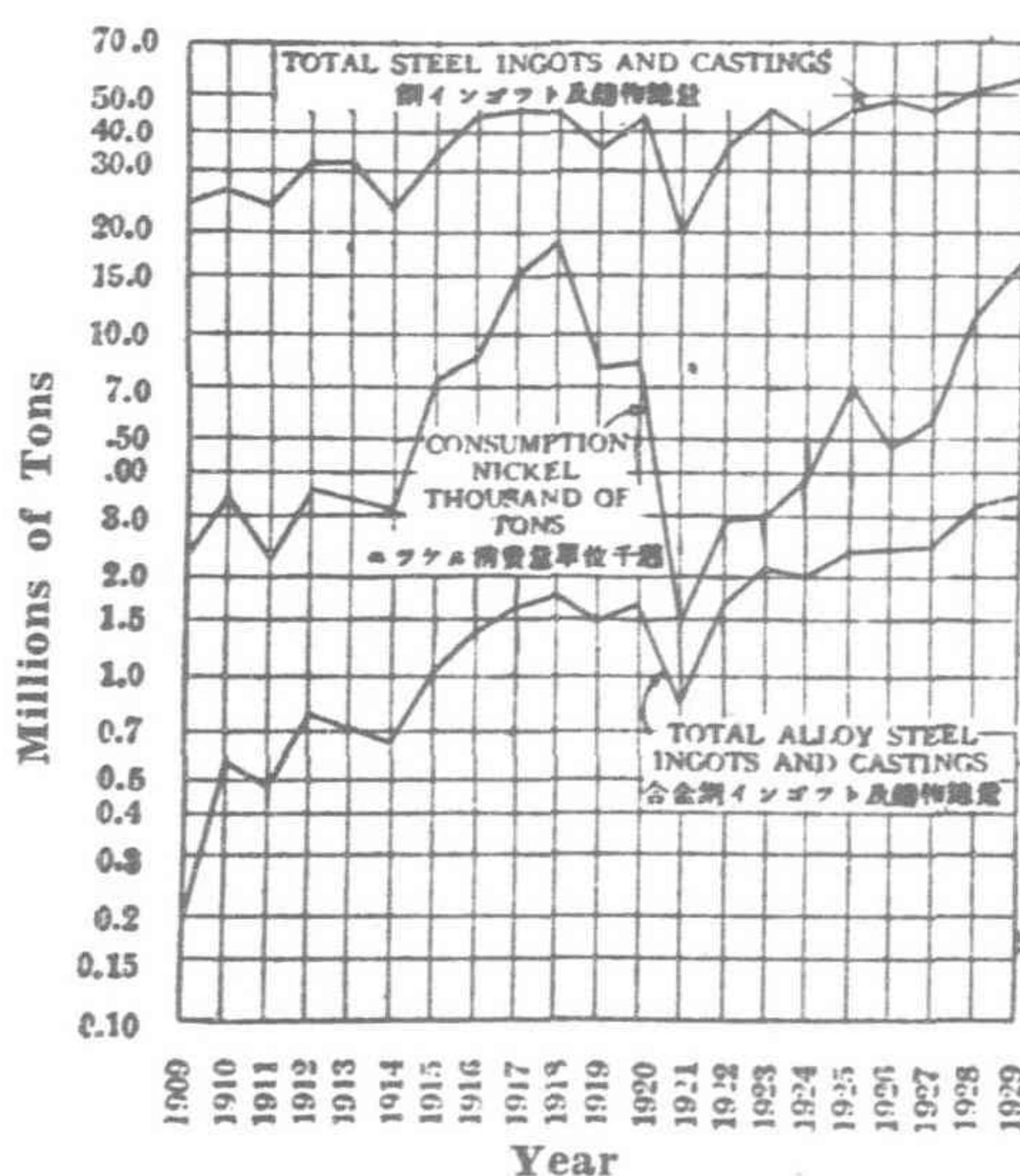


Fig. 30

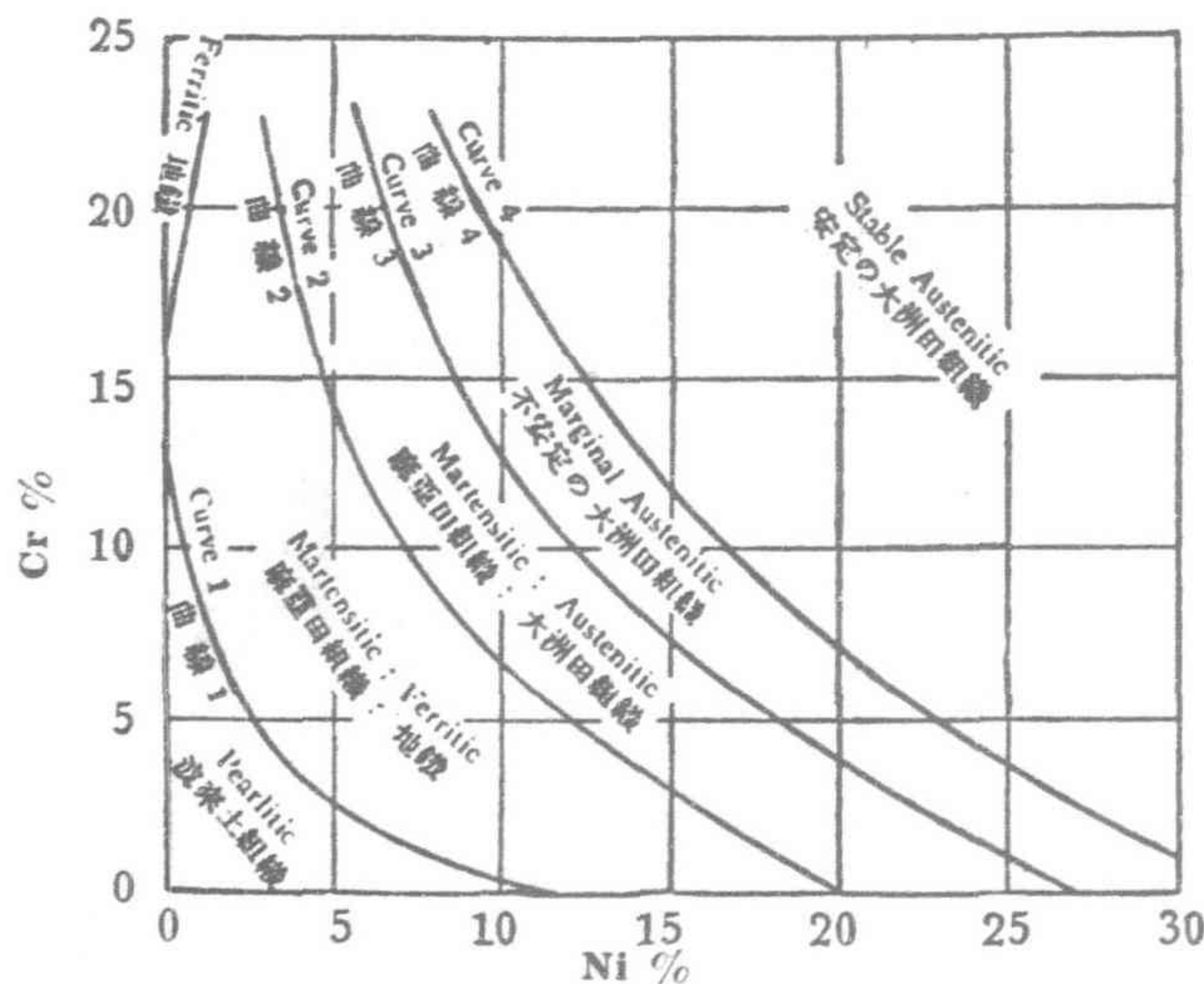


Fig. 35.—Constitutional Diagram of Low-Carbon Nickel-Chromium Steels

dust is in the use of a nickel-molybdenum steel for case-hardened roller bearings. This steel contains about 1.5 per cent nickel and 0.25 per cent molybdenum, and in spite of its greater price is proving more economical because of its greater uniformity and reliability and the ease with which it may be made into bearings.

Crushing tests of rollers of both the older and the newer steels showed a variation in uniformity of over 400 per cent in the breaking load for the old steel, as compared with 10 per cent for the new steel. The minimum breaking load for the old steel was less than half of that for the nickel-molybdenum steel. A set of nickel-molybdenum roller bearings in a billet-mill rolled a large tonnage of steel with a total wear of only about 0.025 mm., whereas the wear on the brass bearings produced by rolling the same tonnage was approximately 38.1 mm. The frictional absorption of power is also reduced so that greater reduction may be made per pass when using nickel-molybdenum roller-bearings.

Although the automobile industry is a major consumer of nickel-steels, it is by no means the only one as may be seen from the

alphabetically listed chapters on the various uses of nickel steels in the latter part of this publication. The following are examples:—

Agricultural Machinery—Cast tractor-shoes, sprockets, gears, shafting.

Bridges—Plates and shapes for bridge construction.

Castings—Railway track crossings and frogs, tractor shoes and sprockets, gears, high-pressure-steam valves, pipe balls, mill guides, piercing points, rack-and-pinion movements rolls.

Forgings—Gears, die-blocks, shafts.

Heavy and Steel-mill Machinery—Press columns, cast press cross-heads, hammer rods, cast and forged rolls, die-blocks, cast shear-blades.

Machine Tools—Shafting and gears, chain drives.

Marine Equipment—Turbine reduction-gears, forged turbine rotors, turbine blading, roller bearings, chain drives, cast high-pressure steam valves.

Mining and Excavating Machinery—Cast rack-and-pinion movements for excavating machinery, cast crusher-jaws, forged and

rolled shafts, cast and forged gears.

Tools—Band and disc saws, punches, chisels, shovels.

The compositions of nickel steels used in these industries are in general similar to those used in the automobile industry, namely, 3.5 per cent nickel steel and nickel-chromium steels with a variety of carbon contents. A number of other compositions such as nickel-molybdenum, nickel-chromium-molybdenum, and nickel-chromium-vanadium, are also used. There are about a dozen types of nickel-bearing structural alloy steels in commercial use. Generally speaking, they are used either because of superior static, dynamic, or fatigue strength, or because of their increased resistance to wear. It is not possible to discuss these many applications of nickel steels in detail, though some of the more recent of them are worth individual mention. The use of nickel-bearing steels for

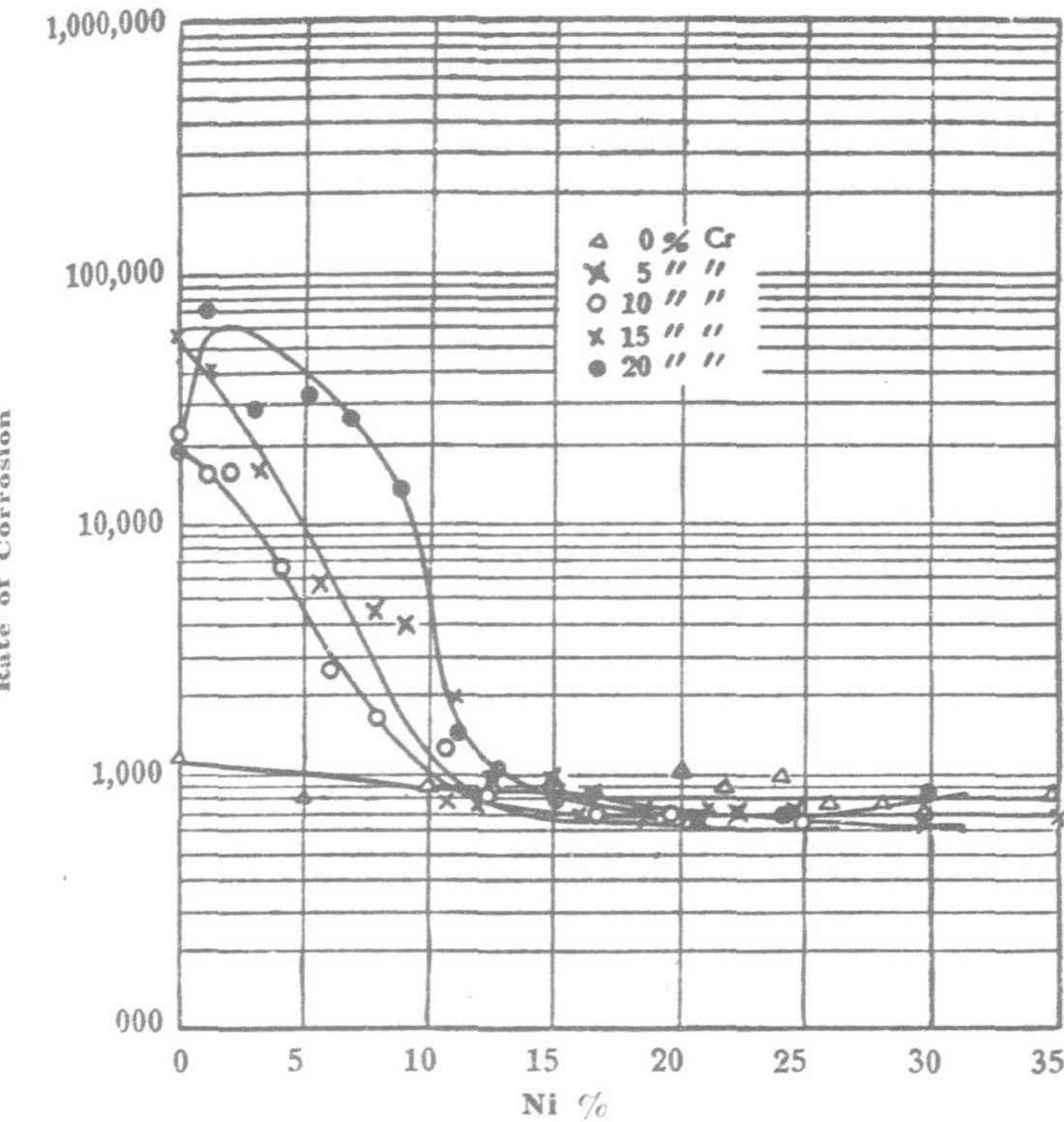


Fig. 36.—Corrosion Rate of Nickel-Chromium Steels in 5% H₂ SO₄

TABLE V.

COMPARISON OF PHYSICAL PROPERTIES OF NICKEL-CHROMIUM STEEL FORGINGS AND CARBON STEEL FORGINGS.

	Ni-Cr Steel	Specifications for Carbon Steel Forgings
Yield Point	55 kg/mm ²	35 kg/mm ²
Tensile Strength	80 kg/mm ²	55 kg/mm ²
Elongation (50 mm.) ..	21 %	20 %
Reduction of Area	55 %	40 %

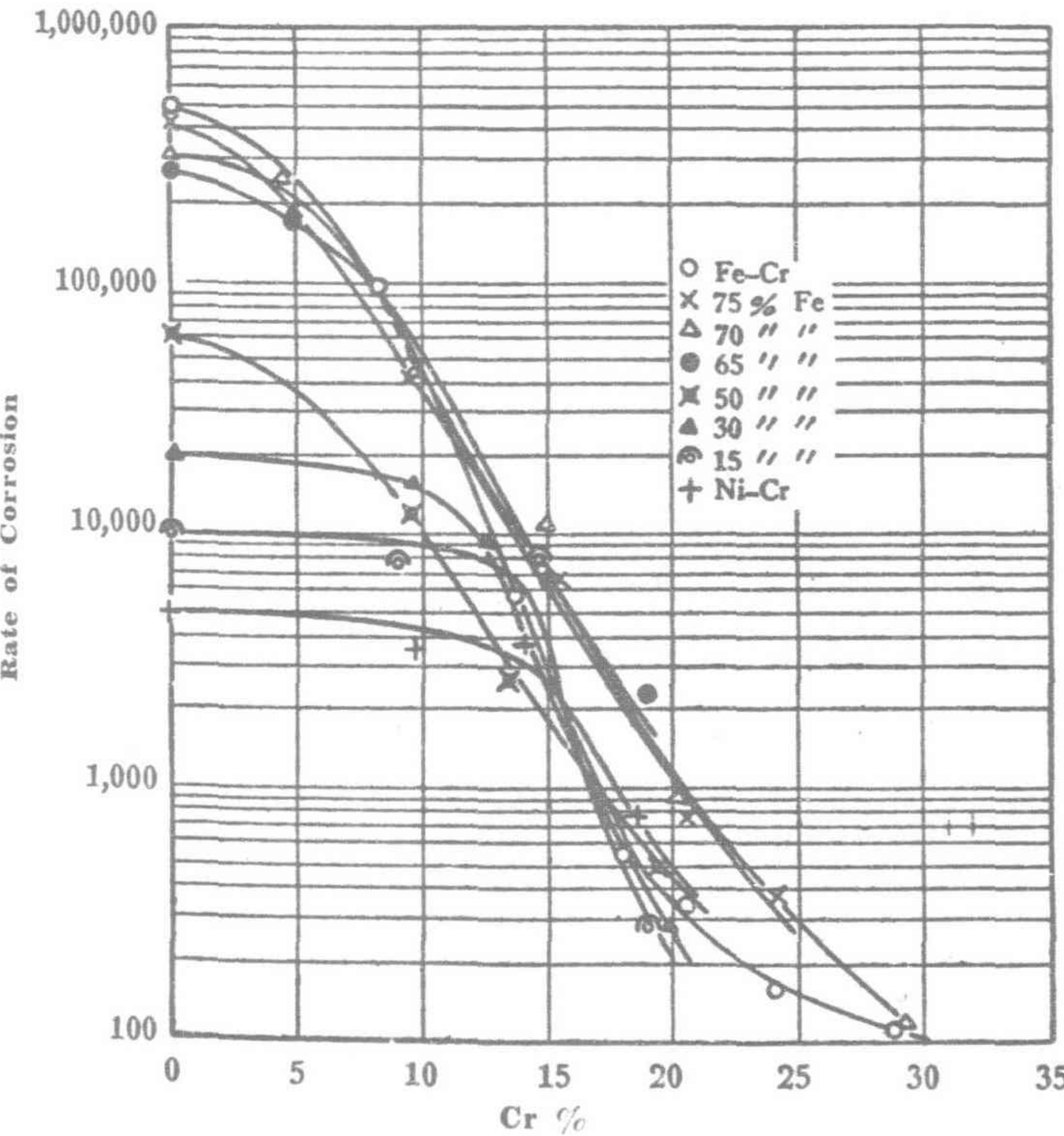


Fig. 37.—Corrosion Rate of Nickel-Chromium Steels in 5% HNO₃

As an illustration of the increased strength which may be obtained in such forgings Table V lists hydraulic-press columns up to 610 mm. in diameter in nickel-chromium steel, which were heat-treated to give the physical properties compared to similar properties of carbon steel. Increased use is being made of chromium-nickel steel die-blocks in the hot-forging of steel. These blocks contain about 1.5 per cent nickel, 0.5 per cent chromium and about 0.45 per cent carbon. With such blocks it is possible to obtain more than twice as many forgings as with the usual carbon block, and, in addition, they do not crack during service. One company estimates that by the use of nickel-chromium die-blocks, a reduction of 50 per cent was secured in the cost of their drop forgings.

In the oil-fields considerable use is being made of nickel-bearing steels for oil-well drilling equipment, in rotary cutters, bits, jars and in couplings. Many of the rotary cutters are now being made of case-hardened nickel-chromium steel head-casting. One well-known manufacturer of steel castings states that since 1920 his production of alloy steel has increased from 10 per cent of his output to 70 per cent, of which 70 per cent is nickel-steel. Both the strength and the resistance to wear of steel casting are increased by the addition of nickel or by a suitable combination of nickel and chromium. These elements are added to increase the strength of racks-and-pinions, high-pressure steam valves, and rolls in special track work, in gears, in tractor shoes because of increased wear resistance, etc.

Castings of nickel or nickel-chromium steel can be annealed to give approximately the physical properties shown in Table VI :—

TABLE VI.

COMPARISON OF PHYSICAL PROPERTIES OF NICKEL OR NICKEL-CHROMIUM STEELS AND CARBON STEELS.

	Ni-or Ni-Cr Steel	Carbon Steel
Yield Point	35-46 kg/mm ²	18-25 kg/mm ²
Tensile Strength	60-70 kg/mm ²	38-40 kg/mm ²
Elongation (50 mm.) ..	18-28 %	20-25 %
Reduction of Area	28-38 %	30-35 %

Another development, in which Canada has taken the lead, is the use of nickel-steels in the railways, particularly in locomotive construction. Rod forging of nickel-steel and nickel steel cast frames have been used in Canadian locomotives. The nickel-steel cast frames were made by a well-known Canadian foundry and gave the physical properties listed in Table VII :—

TABLE VII.

PHYSICAL PROPERTIES OF NICKEL STEEL USED IN A CANADIAN LOCOMOTIVE.

Yield Point	40 kg/mm ²
Tensile Strength	63 kg/mm ²
Elongation (50 mm.) ..	27 %
Reduction of Area	47 %

The nickel steel locomotive stay-bolt is making considerable headway. Comparative tests of 3 per cent nickel stay-bolt steel and of iron have shown that the former has 15 per cent greater strength and 30 per cent greater ductility. In actual service excellent results have been reported of several compositions of nickel steel stay-bolts containing 1, 2 and 3 per cent of nickel. The selection of a suitable steel with proper heat-treatment for a given application is a matter requiring careful consideration.

Because of the increasing severity of operating conditions ordinary structural materials are no longer adequate for many purposes. Nickel alloy steels combining high tensile strength with toughness and resistance to wear, offer the economical and satisfactory solution to many problems. Nickel alloy steels were the first to be used commercially for structural purposes and many data have been collected over a period of 35 years on their performance under a wide range of operating conditions in various industrial fields.

The items illustrated in the following are typical examples of "improved quality" secured through the use of nickel steel. They cover a wide range of industrial uses and indicate countless other applications of nickel steel to machines and parts demanding a high tensile strength combined with toughness and wear resistance.

Note : This is the first of several articles on "Modern Uses of Nickel Alloy Steel that will appear in *The Far Eastern Review*."

Hydro-Electric Power in Kwangtung

Harnessing the Yung River to Supply Canton with Electricity

By Professor C. A. MIDDLETON SMITH, M.Sc., M.I.Mech.E.
(Dean of the Faculty of Engineering, University of Hongkong)

THE most satisfactory method of improving the standard of living in China is that of putting power behind the worker. That will involve the development of the natural sources of energy available. In spite of all of the many difficulties economic, and political, that complicate this work in China, electrification goes on at an increasing rate. New power plants are installed and very soon the demand for electricity exceeds the supply. Nearly all lighting plants are overloaded in China to-day.

Recently a contract involving \$22,500,000 (Hongkong Currency) was signed between the Authorities of the Provincial Government of Kwangtung, in South China, and the Siemens China (electrical) company. The bulk of this money is to be expended on a hydro-electric scheme that will transform the energy of the Yung River into electric power. That convenient form of energy will be available in Canton and the surrounding district.

Canton, the city of Rams—to use its classical designation—is the center of thickly populated area. For more than twenty-five centuries of its authentic history it remained a Chinese city, untouched by outside influences. Arab travelers, and later, in the fifteenth, sixteenth, seventeenth, eighteenth and nineteenth centuries traders from Portugal, Holland, Britain and America, visited Canton. They found it unchanged by the impact of foreigners. For the first two decades of the twentieth century there was very little alteration in the appearance of Canton; the daily life of its inhabitants continued very much in the old routine.

Canton Transformed

Then, almost suddenly, the transformation began to take place. More progress

in adopting Occidental ideas of civilization to this most typical of Chinese cities has been made in the last fifteen years than in all the twenty-five centuries of its previous history.

It is true that, in 1912, Canton built a road wide enough to take vehicular traffic. Soon afterwards the old city wall, built five centuries before the Christian era, disappeared; a new thoroughfare on its foundations now encircles the City of Rams; and it soon became popular when finished and ready for motor-cars.

To-day the white roads are spreading beyond Canton, weaving a new pattern of Occidental civilization in the provinces of Kwangtung and Kwangsi. Motor vehicles demonstrate the value of mechanical power in those Southern provinces.

Public Utilities

Canton has developed, not only its roads, but its public utilities. There is an efficient water supply system, recently installed, at a cost of \$2,000,000. There is a reliable automatic telephone system in the city and a long distance line between Canton and Hongkong.

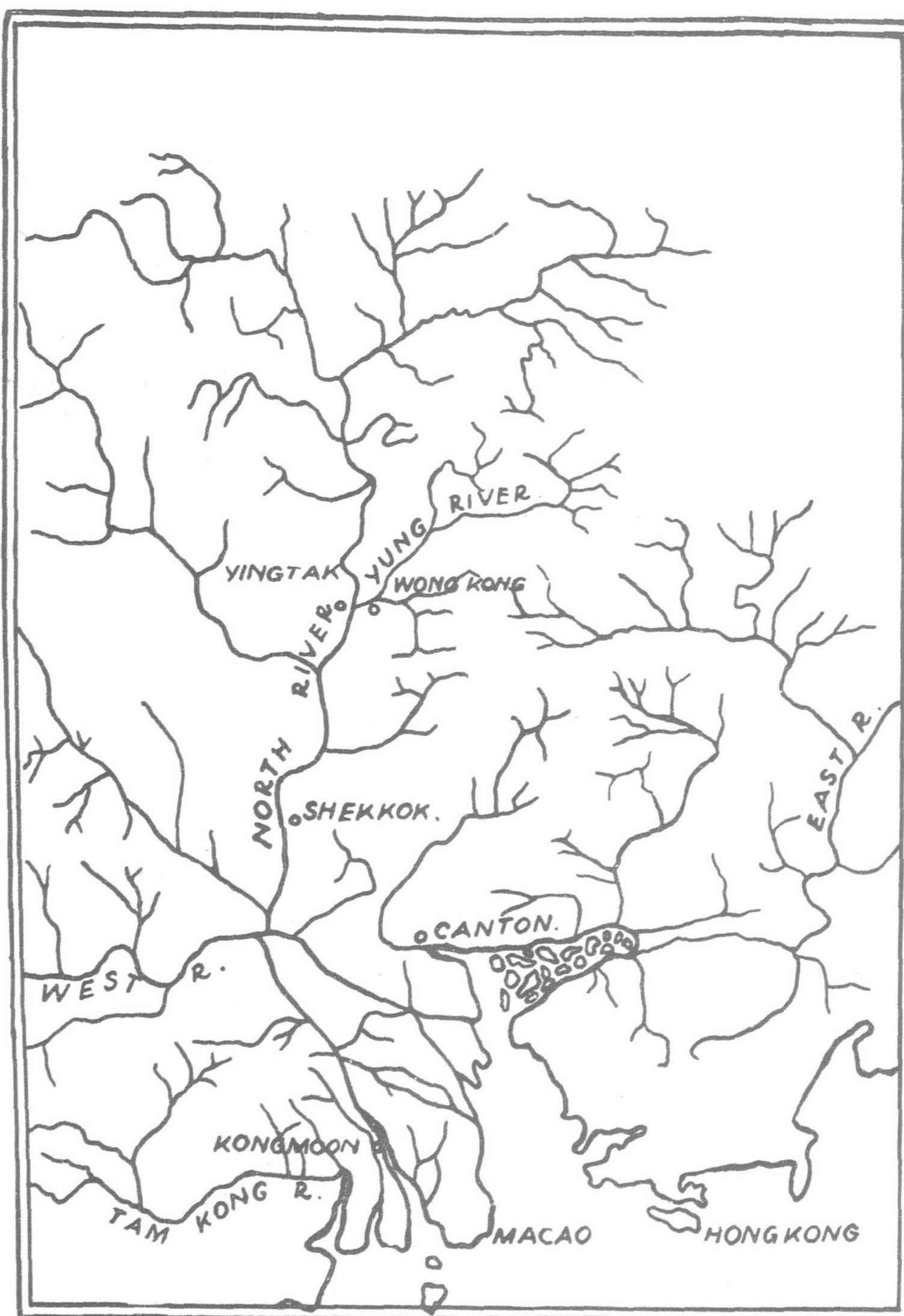
There are now in Canton many new buildings of modern design, mostly of reinforced concrete construction. The Sun Yat-sen Memorial Hall reflects great credit upon the designers and the builders. It incorporates the typical style of Chinese architecture, with its beautiful curved roofs, and the modern science of structural design.

The civic center is well planned. And reclamations are being made so as to improve the river bund. Nor must reference be omitted to the new bridges, built and in course of construction, across the river.

Power in Demand

Yet, in the writer's opinion, nothing is more

KWANGTUNG DRAINAGE AREA.



SCALE 1:2,000,000.

important for this industrial district than a reliable supply of electric power.

Canton has had its steam and oil engine generating plant for years. It is, to-day, overloaded daily. It is difficult to obtain facts and figures about the economic possibilities of this plant, as unfortunately it seems to be the habit of Canton officials to demand, and to obtain, electric current without paying for it. The plant has been badly overloaded for years past, despite several extensions.

In spite of these, and other difficulties, knowledge concerning the advantages of electric power is spreading all over the industrial areas in Kwangtung. The complete alteration in the mental outlook in the last two decades of the official and merchant class in China, towards machine industry is most significant.

This immense change in the attitude of the Chinese people towards applied science, must be emphasized, if the possibilities of expansion of the demand for machinery is to be realized. Whereas, for centuries, the Chinese did their utmost to stem the inevitable tide of the new knowledge entering their country they now seem to do all that, as individuals, they can do to encourage the study and application of science. That one fact makes the transformation of China by the engineer certain.

Evidence of that change is the rapid rise in the number of engineering students entering the Hongkong University, in spite of the raising of the standard of the entrance examination in recent years.

The Yung River Scheme

A few days ago an official announcement was made that a contract for about £1,600,000 for the Yung River scheme for a new electric generating plant had been signed. Since then the writer has discussed the details with Cantonese officials and the contractor's engineers.

The deciding factor in placing this scheme was finance. The chief electrical engineer for the Kwangtung Department of Reconstruction was an engineering graduate of Hongkong University, Mr. Man Shu Sing, B.Sc. (ENG) who had been trained in modern engineering standards. He had spent some years in developing the details of this hydro-electric power plant and transmission scheme. Mr. J. N. Jenssen, a Canadian who represented the Fraser Brace Engineering Corporation of Montreal, spent some time on preparing a detailed report and estimate of cost for this project, about four or five years ago. Other engineers had explored the project, and they realized the possibilities of the scheme; but in the end the Germans secured the contract on a financial basis which did not satisfy other competitors. Whether, as is locally rumored, the Germans had the backing of their own Government, is not certain; but it is thought to be probable. The fact remains that a contract for £1,600,000, for electric supply, has been recently placed in Canton.

In 1933 the Kwangtung Department of Reconstruction sent the Yung River Hydro-Electric Commission, composed of electrical, civil and geological engineers, under the supervision of Mr. Man Shu Sing, Chief electrical engineer of the Department and Chairman of the Commission, to investigate, anew, the problem of harnessing the water power available.

The Yung River is located in the northern part of the province of Kwangtung, and is a tributary of the North River. It originates near Yung Yuen, a mountainous district in the northern part of the province, and flows south-west into the North River near Ying Tak City, close-by the Yuet Han Railway. The average slope of the river is about nine feet to the mile. The two banks of the river are for the most part, especially that part, between Wong Kong and Liou Mouth steep and rocky, rising to elevations of from 300 to 1,500 feet. The Yung River basin has a drainage area of approximately 1,490 square miles. The average annual rainfall there, according to the records was about from 90 to 100 inches—the latter figure is for the period from 1919 to September, 1930, an average record of eleven years. The average flow of water in the river is about 5,500 cubic feet per second. It has, however, been as high as 20,000 cubic feet per second and as low as 1,035 cubic feet per second.

All along the Yung River from its sources to its end, exhaustive surveys were made of all possible sites to select the best and most economical site for building the dam and power plant. The most favorable sites were found to be at Gin Shui Ngam and Wong Kong.

Creating a Lake

A gravity type dam is to be built across the Yung River. The height from the foundations will be 140 feet. The dam is to be of reinforced concrete; any amount of sand and granite being available on or near the site. The length of the crest will be about 600 feet. The width of the dam at the top will be 20 feet and at the base 93 feet.

The long narrow lake created by the dam will be 11.5 miles long, with a storage capacity of 1,576 million cubic feet.

The original plan was to draw 5,000 cubic feet of water per second from the lake, which, under a gross head of 119 feet, will develop 54,000 b.h.p. or, say 40,000 kw. assuming average efficiencies.

This scheme was envisaged for three generating units each of a 21,000 b.h.p. vertical turbine, coupled direct to a 16,700 kva. That has since been modified and one of the Chinese engineers concerned with the project, has informed me that four machines, each of 10,000 kw. will be used, and 11,000-volts (three-phase 50-cycle) generators will be installed.

The power generated will be carried by double circuit transmission lines, supported on steel towers, spaced 750 feet apart, to the substation at Sai Chuen, on the outskirts of Canton. The length of the transmission line is about 90 miles. These towers are of the trellis type, some 70 feet high.

The power generated will be stepped up by transformers from 11,000-volts to 110 kv. for high tension transmission. At Sai Chuen it will be stepped down to 3,300-volts for distribution.

At first only three turbines will be installed, but when the demand for power justifies it, the fourth turbine will be placed in use.

There can be no doubt about the certainty of the increase in the demand for power. The number of factories in Kwangtung is rapidly increasing. The demand for electricity in the industrial and thickly populated district, which this scheme will supply with power is much greater than the supply systems have been able to meet in recent years.

The following is a quotation from the report made by the Hydro-Electric Commission, of which my friend, Man Shu-sing was Chairman. "Kwangtung is rapidly developing as a great manufacturing province, and consequently the demand for electric power increases. As there is a scarcity of coal deposits in the province, the only way to meet this increasing demand for power is to utilize as much as possible the abundant water power resources of the province."

Other Projects

It must be conceded that in many electrical schemes in China, the economic projects have in the past been ruined by mismanagement. Chinese officials have not paid for their current, and incompetent Chinese engineers have been appointed by official or family influence.

But there is reason to believe that this Yung River scheme will be managed efficiently, when once the power supply is available. The writer is more sanguine about that than are many other Europeans in South China engaged in commerce in China. He believes that the new generation of young Chinese, especially those properly trained as engineers, are capable of doing good work. The "old China hand," is apt to find fault with the new generation; but the experience of twenty-two years with them in the Hongkong University gives me a more hopeful outlook.

The age of power production has commenced in China. It must be emphasized that there is an entirely different attitude of mind shown by present-day Chinese officials on these technical problems, as compared with that of their predecessors of a quarter a century ago. And it is that change in outlook which must accelerate power production in China. Of course corruption will delay progress, but publicity will finally kill that dragon in the path.

The Triumph Near Tibet

Far away in the interior of China, 200 miles east of Tibet, there is a tiny hydro-electric plant providing light to the Chinese village of Tai Chien Lu. It is only a little 25 kw. generator; it was supplied from stock in Shanghai; and, as compared with the giant power units, exceeding 100,000 horse-power in use in America and Europe, it is but a pigmy. The water turbine driving it is only 40 h.p.

But it is of great interest, for it is a wonderful demonstration plant of how to utilize the power of a rushing stream.

And it is a triumph of human endeavor. It took 16 coolies nearly two months to carry one piece of the machinery on their backs from the nearest port, Yochow, to its destination. They had to cross two mountain ranges, where the passes were heavily covered with snow and ice. In some places the road had completely disappeared; in others dangerous bridges had to be manipulated with very great ingenuity. The Chinese engineer, who installed the plant, left Chungking (about 1,450 miles up the Yangtzekiang) in December, 1930, and arrived in Tai Chien Lu on May 3, 1931, being delayed by the loss of a shipment of electrical parts. The junk used for transport of the gear foundered.

Finally the promoters succeeded in supplying electric light to Tai Chien Lu. "It was" says the report "a great night in Tai Chien Lu. Huge crowds flocked to the power station to watch the lights function for the first time. It was a time of anxiety and excitement for those responsible for the scheme, but everything went splendidly; a faint glimmer and a blaze of light. Electric light in the border town is now an accomplished fact."

And the people of Tai Chien Lu—Chinese and Tibetans—were soon clamoring for more electric light.

In the University of Hongkong we have thousands of Chinese visitors visiting our several engineering laboratories. The demonstration that most delights them is one with a tiny hydro-electric plant; when we open the valve to admit water to a small Pelton wheel which drives a dynamo big enough to supply light to the laboratory they show great approval. Perhaps they understand what takes place, it seems so simple; and possibly they are puzzled by the other experiments with heat engines, electrical machinery, etc.

Fascinating Projects

Few engineering exercises are more fascinating than that connected with the development of electric power generation in China. The dragons in the path of progress are finance, political troubles and corruption. These, it is believed, will be overcome in time—or, shall we say, become less formidable as their teeth are extracted.

Three years ago that splendid publicist and doyen of the engineering profession in the Far East, George Bronson Rea, contributed in this Journal (child of his active and progressive mind) "Some Thoughts on the Electrification of China." That article gave me much material upon which to think when it was first published; I have often read it again since it first appeared. The reader will learn something useful from it, if he consults it to-day. It may be permissible to quote the considered view of one who has spent nearly all of his life in the endeavor to accelerate mechanization (and so improve the standard of living) in China.

This is what Mr. George Bronson Rea wrote in the *Far Eastern Review* May, 1931.

"It is easy to recognize the difficulties of a technical, financial and political nature that must be overcome, but the economic advantages are considered to transcend all obstacles. The lessened cost of power to the consumer, the greater spread of available power to a multitude of users, the inevitable enhancement of goodwill among participating nations are powerful incentive to the consummation of the plan."

And, later in his contribution, he wrote "Aside from the minor and perhaps remediable hindrances to the profitable operation of electrical plants in China, the main obstacle to any rapid growth of power systems is the absence of a demand, that can be created only by the industrial growth of the country. A certain sure and gradual development of existing plants can be looked for in the increase of the requirements for house lighting, ventilating fans and minor motors. There are also many cities, towns and villages, that can afford the luxury of electric light instead of candle and oil illumination, and there are several good possibilities for the use of power in coal mines, especially in transporting the product to the main transportation lines."

Those words apply to China to-day and express, clearly, the views of the present writer.

The Cantonese from Overseas

The provinces in South China have had the reputation for being very progressive. Thousands of Chinese have returned

from overseas, to their native towns and villages in those provinces, bringing with them ideas which make them advocates of Applied Science in China. Yet the Yangtze Valley presents the greatest problem of power production in the world to-day. And, granted the great volume of that river, let us not forget that there are countless other streams in China capable of producing electric power.

A recent visit to Japan, where the energy of each mountain torrent, every rivulet with any fall, seems to be utilized, gave me much food for reflection as we journeyed last year the 1,450 miles from Shanghai to Chungking.

In many ways this problem of hydro-electric power fascinates the engineer in China, for so much traveling is done on the long inland waterways. And a glance at the map shows that many parts of the country are well-watered, to non-technical minds, it seems nowadays such a simple matter to transform the "white coal" of the rushing waters into electrical energy in demand in cities, towns and villages.

Will Transformation Come in Our Day?

There is a great network of navigable streams, connected with the Yangtze, running in all directions in Central China. The district, is not destitute of coal, yet very little of it is being mined. To develop a coal mine is often an expensive matter, requiring a good deal of capital. But there is much water power, capable of gradual development. And in many places the capital outlay for fairly small plants is not great.

The Yangtze river, more than 3,000 miles long, has many feeders of varying size. At the coast the annual mean discharge is over one million cubic feet of water per second, more than four times that of the Mississippi, and a hundred times that of the Nile. The old Thames discharges only 2,300 feet per second. The Yangtze at Ichang, 960 miles from the sea, discharges 244 times as much water per second as the Thames at London, where it is distant from the sea forty miles only. And the Yangtze rises in mountains at a height 20,000 feet above sea level; the main river and many of its tributaries are, for great distances, well over 5,000 feet above sea level.

Dr. Sun's Hydro-Electric Scheme

At one part of its seaward journey, 550 miles from its source, the river is 9,000 feet above sea level. For the first 400 miles to that place the fall is only about 14 feet to the mile, but in the next 150 miles the fall is 6,800 feet—say 45 feet per mile.

Many years ago Dr. Sun Yat-sen (educated in Hongkong) published a vague, and grandiose scheme of water-power development for the Yangtze. He suggested enormous dams and locks in the gorges, about 1,200 miles from the sea. His scheme was impracticable, because of the tremendous cost, and also because of the distance from any industrial centers demanding electric power. And the big rise and fall in the height of the river at different seasons added to the difficulties.

Mr. Chen Kung-po, the Minister of Industry in the Nanking Government spoke to members of the Hongkong Chinese Chamber of Commerce recently. He revealed the difficulties encountered in reconstruction works, especially in connection with the opening of an electric power plant at Ichang to utilize the water power of the Yangtze. He said that the project required a capital of \$50,000,000. But what is the prospect of the demand for such an enormous output of electric power within an economic radius of Ichang?

Far better to commence with less expensive schemes and to plan to link them up as the load increases. It is easier to raise \$5,000,000 than \$50,000,000. And it is easier to earn a dividend on the former sum.

There can be no doubt that, because of the difficulty of obtaining suddenly a big load, and also because of the difficulty of obtaining a large capital sum, efforts should be made to commence with smaller hydro-electric power schemes in China.

The Money Factor

Of course, if we could ignore that dragon of all the uneconomic engineering schemes, finance, it would be possible to plan a most wonderful scheme for an electric grid scheme for Central China. It

(Continued on page 235)

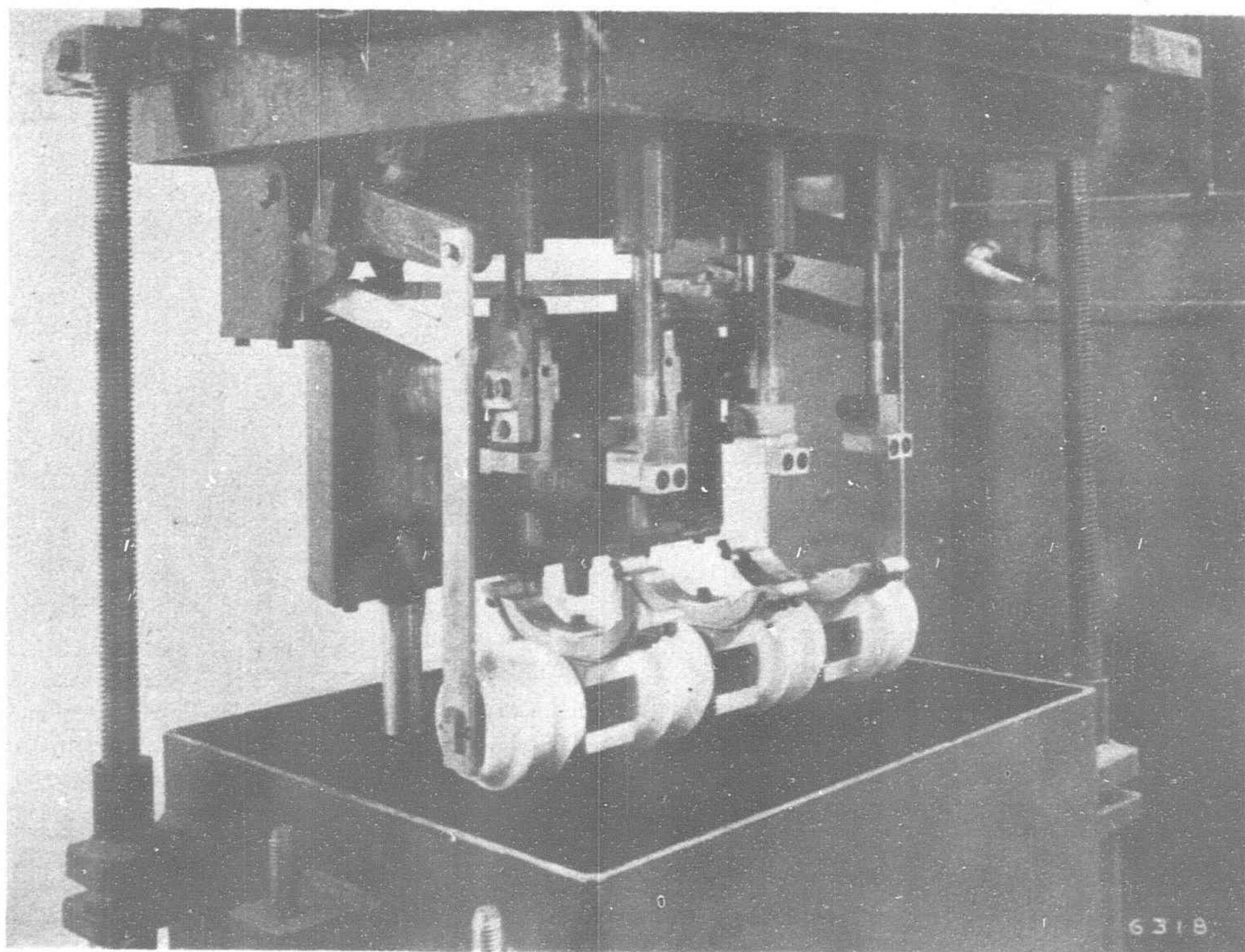
Circuit-Breakers for Outdoor Service

Type "Ply 15/50"

DEVELOPMENT in rural electrification and the increasing capacity of distribution networks necessitate more robust equipment for the control of tee-off circuits for small consumers, and the need is best met by the installation of high-breaking-capacity oil-immersed circuit-breakers. The use of an automatic circuit-breaker also makes it possible to have more complete discriminative protection of the main supply-cable and the branch feeder, to the advantage of both the consumer and the Supply Authority. The work and cost of maintenance are reduced to a minimum, and restoration of service can be effected with the least possible inconvenience under all weather conditions, especially if automatic reclosing mechanism is also used.

Type "Ply 15/50" circuit-breakers have been developed to meet such requirements, and are suitable for mounting either overhead on poles or at ground-level. Although they are of light and compact design, they have ample mechanical and electrical factors of safety to provide an adequate margin on their breaking-capacity rating of 50,000 kva.

Like all Reyrolle products, they are backed up by the accumulated world-wide experience, the extensive test-plant research, and the careful attention to details that have made the name of Reyrolle synonymous with high reliability and satisfactory quality.



View of circuit breaker with tank lowered showing arrangement of contacts and trip-coils

Constructional Details

The top-plate is of cast iron, and carries the whole of the circuit-breaker mechanism and the tank. On each side there are three flanges, to which cable-glands or lead-in insulators are bolted as required.

The tank is of $\frac{1}{4}$ -in. (6 mm) welded steel plate, and is fixed to the top-plate by means of six bolts, of which four are $\frac{5}{8}$ -in. (16 mm) in diameter and two 1-in. (25.4 mm) in diameter. The 1-in. bolts are specially arranged to facilitate the raising and lowering of the tank.

Overcurrent protection can be provided on one, two, or three-phases. The trip-coils are of the direct-acting series type, and adjustable current-settings, varying from the normal rating to three times the normal rating of the trip-coils, may be obtained by means of calibrated inverse-time-limit dashpots. The setting-mechanism for the dashpots can be mounted externally if required. Standard trip-coils are available of the following normal ratings: 2.5, 5, 10, 15, 30, 60, 80, 100, 150, and 200 amperes.

It should be noted that the copper-section of series trip-coils of from $2\frac{1}{2}$ ampere to 10 ampere normal rating limits the breaking-capacity of the circuit-breakers, and the rating of 50,000 kva at 12,000-volts is only applicable to circuit-breakers fitted with trip-coils rated at 15 amperes and upwards.

The moving contacts are of the laminated-brush type with heavy backing-springs, and are fitted with arcing-tips. The three sets of contacts in a three-phase circuit breaker are mounted on a common plunger-bar.

Operating-Mechanism

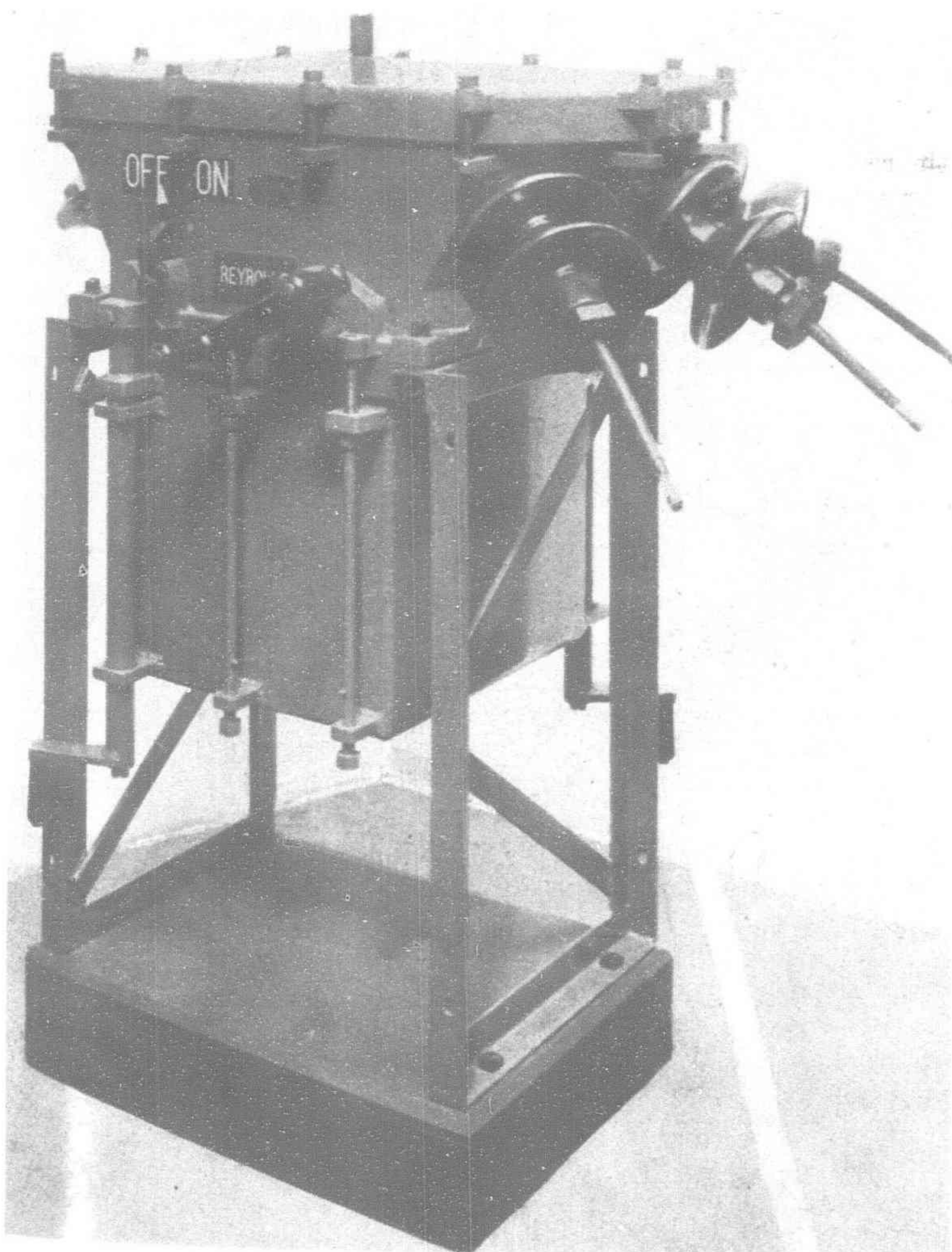
The operating-mechanism is inside the tank, and the operating and position-indicator shafts are brought out through weatherproof packing-glands. Operation is by hand, either direct or from the base of the pole, and the operating-handle can be padlocked in the "on" and "off" positions.

A mechanical automatic-reclose mechanism can be provided, permitting one, two, or three recloses before locking out.

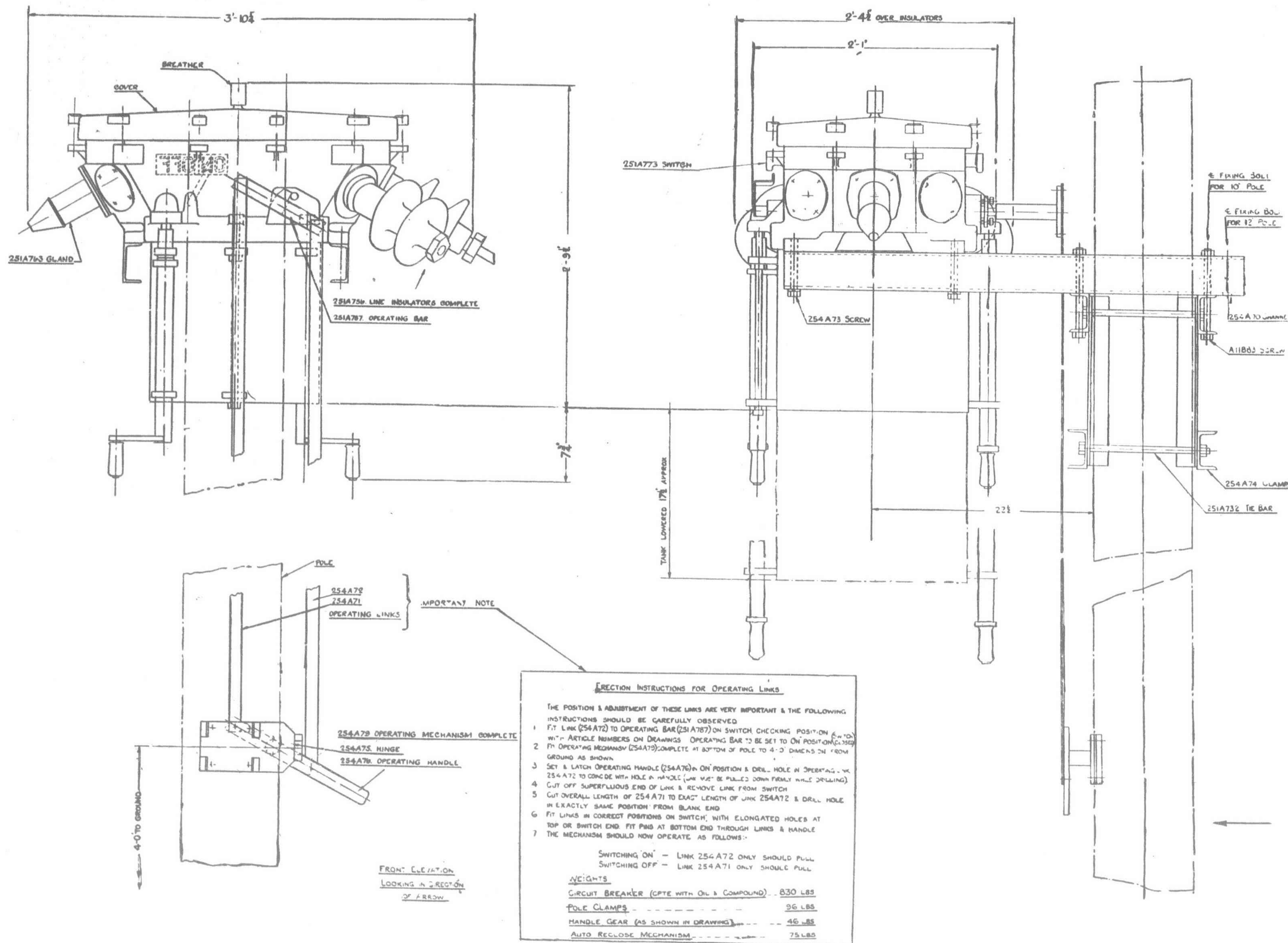
Terminal-Arrangements

Up to three cables or open connections can be accommodated on each side as required, in any of the ways shown in sketches A, B, and C of Fig. 2. Cable-glands are of the standard universal type, and can be fitted with armoring-clamps. Insulators for open connections are fitted with screwed stuffing-glands, which grip the insulated connections from the overhead lines.

(Continued on pages 220-235)



View of circuit breaker mounted on pedestal for display. Type "Ply 15/50" up to 15,000-volts 200 amperes



Regulation of the Fen Ho for Flood Protection and Conservancy of Winter Flow as an Aid to Irrigation

A Report Prepared from Surveys Made in 1933 for the Shansi Water Conservancy Commission

By O. J. TODD, Chief Engineer, China International Famine Relief Commission

(Continued from April, 1934)

Transport Studies

AT the close of the year reconnaissance and preliminary surveys were being made for a motor road to connect Taiyuanfu with Lo Fan and the No. 1 dam site on the upper Fen Ho. Two routes were studied and further surveys are being made on which to base estimates of cost of the more desirable of these.

The cost of stone for river bank revetment work has been too high in the past making this work seem prohibitive for the Pingyao-Chiehshiu district. Studies of transport from the Lantsun region by short cart haul to the river and then by boat in the warm months or by sled over ice on the frozen river in winter have proven most valuable and made the problem of a stone protected, fixed Fen Ho channel through the Taiyuan plain appear practicable. All large movements of stone must be by boat for long haul.

Comparison of costs on present roads in Shansi indicate that with labor prices and gasoline prices of 1933, haul by ricscha over graded motor roads is somewhat cheaper than by auto truck for such materials as cement in bags or other heavy freight in small units. On the cart roads camel back transport is desirable if there are many steep pitches or river crossings. This applies to cement haulage.

The construction of the new narrow gauge railway from Taiyuanfu both north and south during 1934 will materially reduce haulage costs below present rates of 22 cents to 30 cents per ton-mile by ricscha or 30 cents to 35 cents by auto truck. Rail and boat haul will always be used on dam construction when possible. Where these are not practical in Shansi graded roads for ricschas and auto trucks are desirable.

History of Fen Ho Regulation

Little seems to have been recorded regarding the problem of river regulation for the Fen Ho during the many centuries that its fertile valleys have been cultivated. There are no evidences of large stone protective works such as are found along the Grand Canal or the Yellow River. Efforts to keep the channel in a fixed course were not on a comprehensive scale. The small groin made

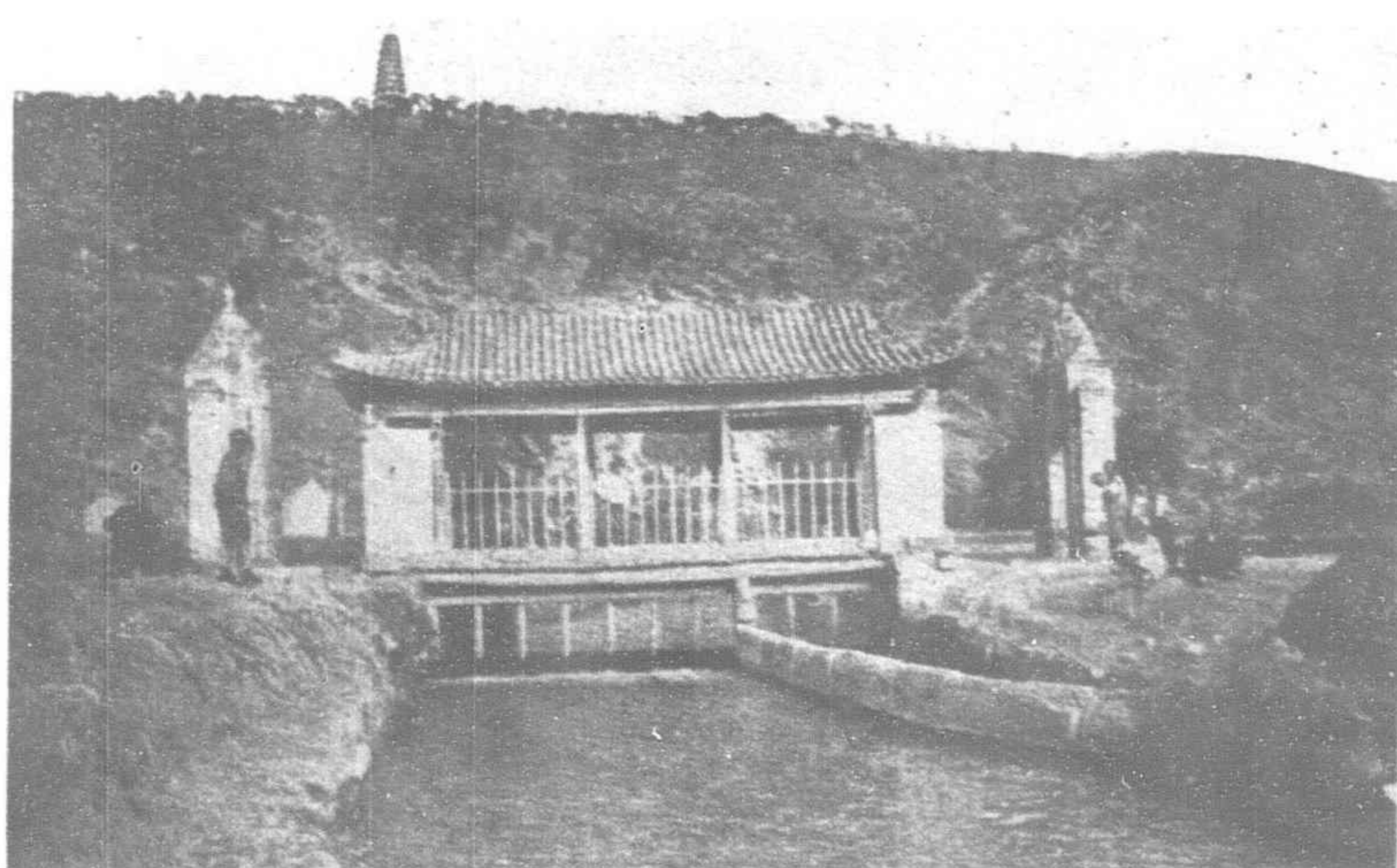
of short piling with woven willow fascine work and a filling chiefly of earth is illustrated in a cut from a photograph taken by me in 1924 when first studying this river. This method of holding the river in check seems to have been adopted at times and to have served the purpose in moderate stages supplementing the ordinary earth dike lined with willow trees. The system of each county or hsien keeping up the main river dikes within its borders seems to have been generally adopted long ago though upkeep was not always uniform.

The use of water appears to have demanded much regulation and through the past centuries understandings grew up whereby various irrigation districts, each having one or two main canals, had an understanding with other irrigation districts as to priority rights. From Chingyuan down to Chiehshiu, until recent years, these districts had formed eight groups which in turn took the full low water flow of the Fen Ho for late fall and winter irrigation. The first dam of piling, kaoliang stalks and earth was built in late October near Chingyuan and diverted all the Fen Ho into its canals for 27 days. Meanwhile the next earthen dam of similar construction was being constructed a few miles downstream to divert the full flow into its canals in its turn when the first dam was cut after serving its purpose. This second dam operated 24 days. So on down the river through the Taiyuan plain this rotation of use followed until 20 canals had been served by eight earthen dams during the winter. Then in early March the river was free to all and those farther up river made their own brush and stone diversion inlets to get spring irrigation. These structures were spurs that never were allowed to go entirely across the river and therefore diverted but a part of the flow. There were 48 canals above Chingyuan below the gorges at Lantsun that were thus supplied in the spring months, but were not permitted to take water between late October and early March. These upper 48 canals were known as "mud canals" and took natural flow without any artificial rise of head. This group irrigated 300,000 mou of land. The 20 canals below them, taking water with a slight head due to the eight dams employed, gave service to 500,000 mou.

The Tung Li canal, and others of less importance along the lower Fen Ho, used similar methods of spur diversion in medium water but built their crude native dams across the river in very



Temporary Diversion Dam near Chaocheng, Shansi on the Fen Ho



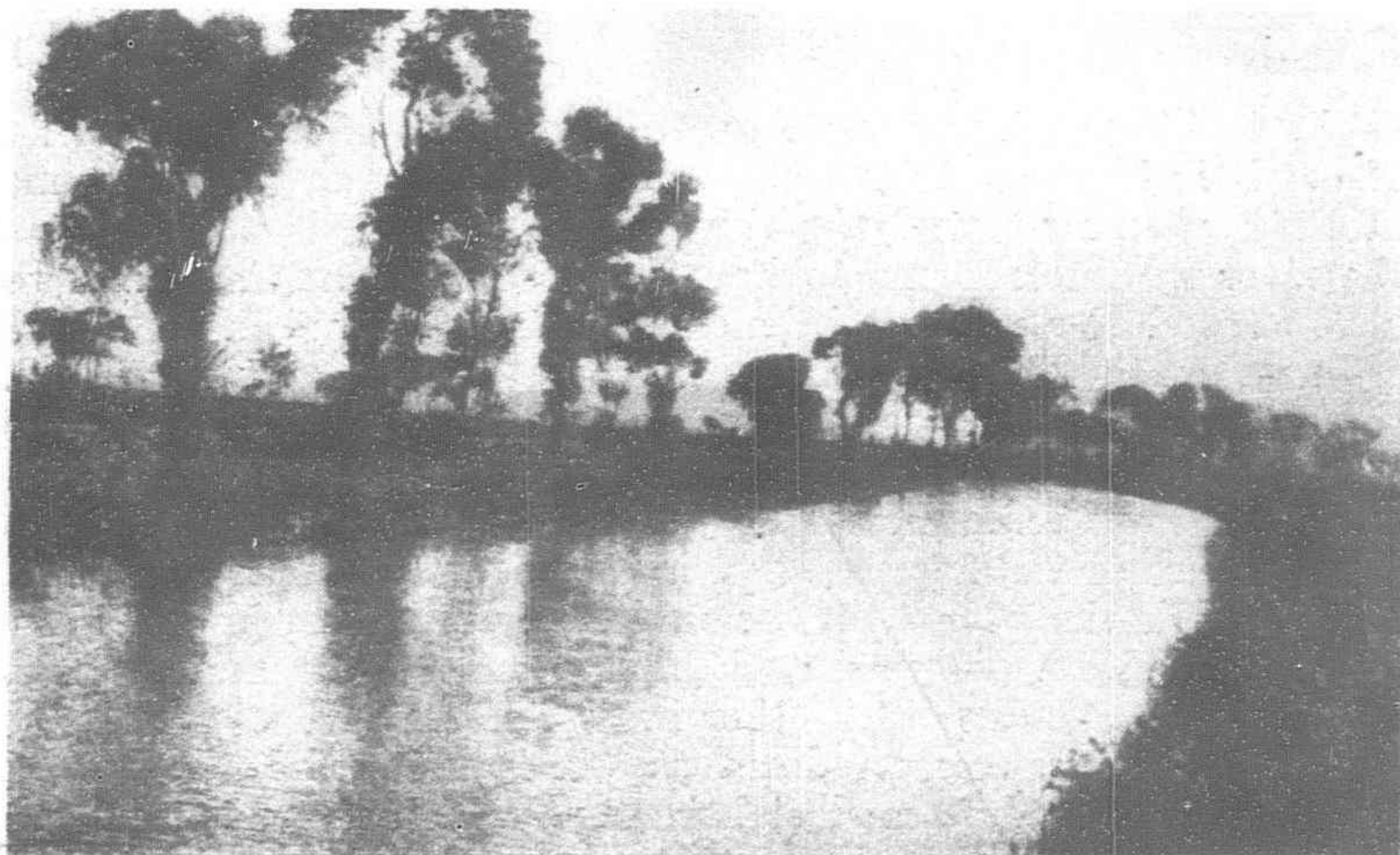
Kwang Sheng Sze Spring in the Lower Fen Ho Valley (90 to 100 second-feet flow)

low water sometimes getting a head of three feet as is shown in one of the cuts.

The history of the use of Wen Yu Ho water for irrigation is marked by conflicts between various groups of users. Similarly the water of the famous Kwang Sheng Ssu spring in Chao Cheng has been a source of local struggles. Now it is divided so that one-third goes to Hung Tung and two-thirds to Chao Cheng Hsien. Neither store the winter flow but villages along the canal have established small grist mills with drops of three to seven feet and claim the right to use the flow of water for power purposes. Similar power rights have been established just below the Chintzu spring

and help complicate the problem of storing waste winter flow for spring and summer use in irrigation.

No historical records are found showing that any water storage or conservancy in the more modern sense has ever been practised along this river. Only the natural flow has been used. Diversion by masonry dams, as stated heretofore, began under the direction of Mr. L. H. Wang in 1930 as also did the installation of pumping plants to get Fen Ho water on land that was as much as 30 feet higher than the Fen Ho in low stages. It is from this point in the development of the Fen Ho that we propose to start and have made these studies with more extensive improvements in view.



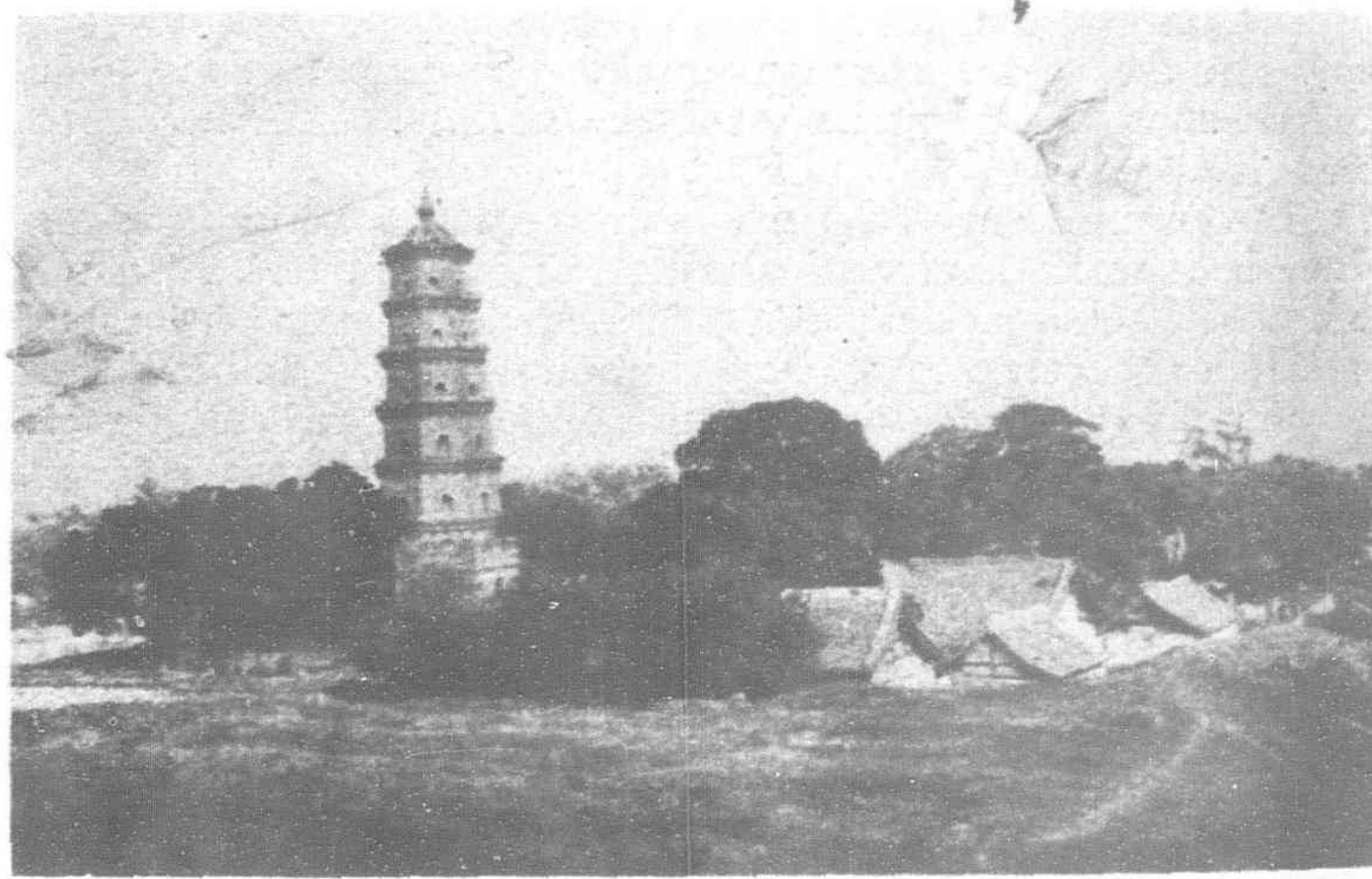
A channel of clear water for irrigation near Lantsun 40 li North of Taiyuanfu



One of the outlets of Lung Tze Sze Spring in Lower Fen Ho Valley (90 to 100 second-foot flow)



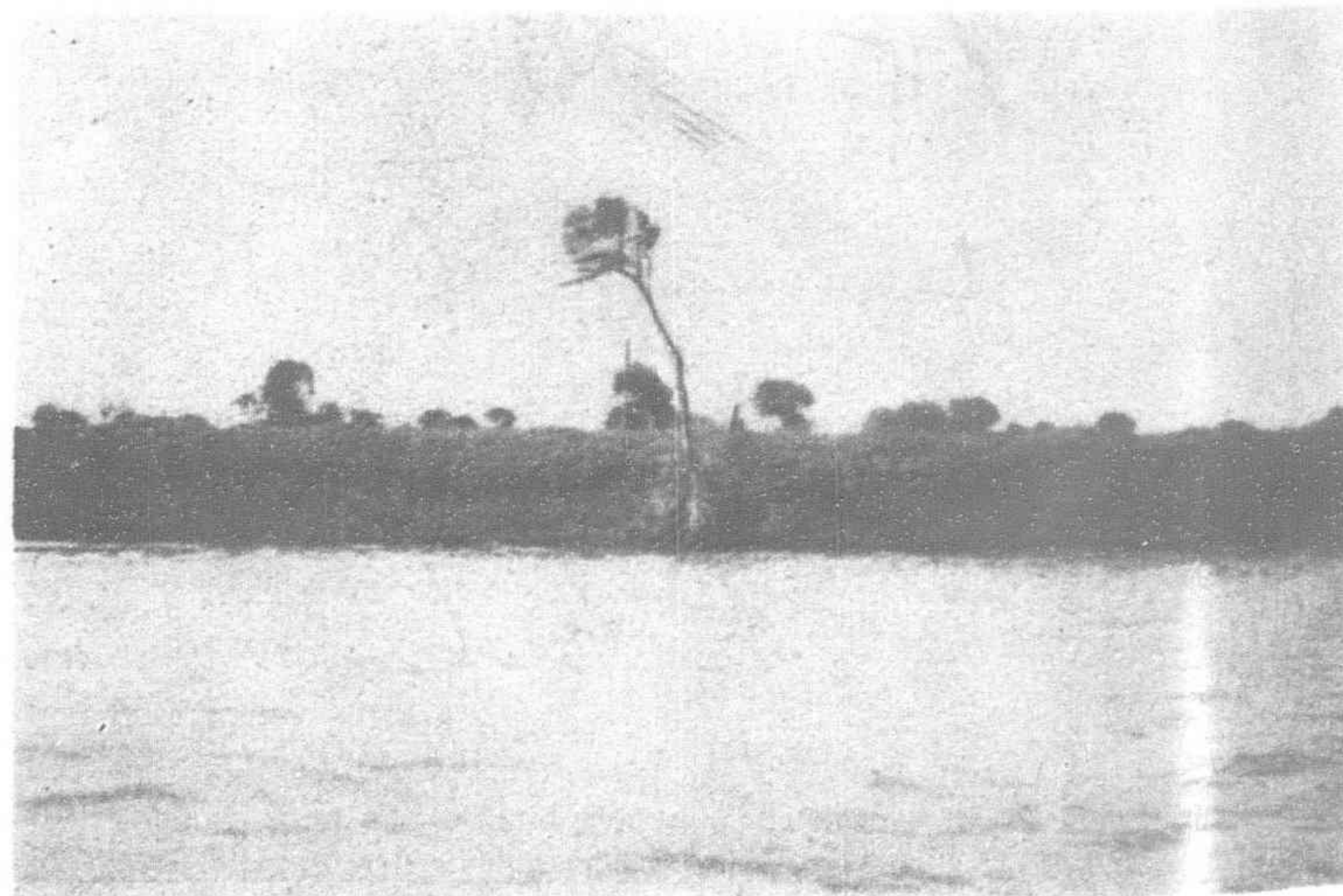
Kwang Sheng Szu Spring lies high above Valley Lands



Chintze Springs 40 li South of Taiyuan



At Hotsin pumping plant



Fen Ho Dikes near Pingyao being cut by sudden rise of water

The Proposed Plan

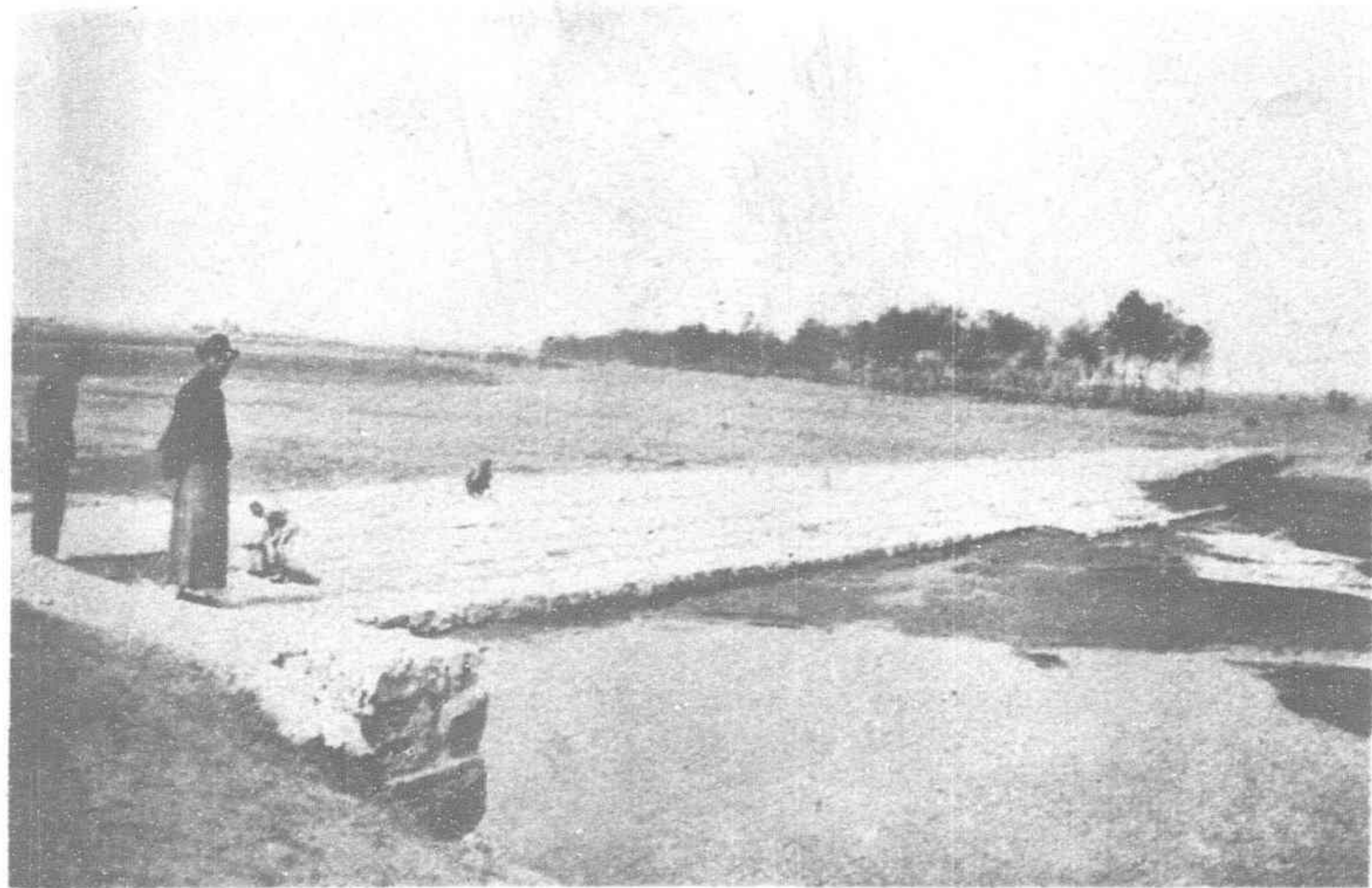
Based on our investigations of 1933 the following steps are recommended in connection with the solution of the flood control and water conservancy problem of the Fen Ho.

- (1) Construction of a dam on the upper Fen Ho near Hsiachingyiu for storing winter flow for spring irrigation.
- (2) Constructing reservoirs just below the three large springs—Chintze, Kwang Sheng Sze and Lung Tze Sze—to empound winter flow for spring irrigation.
- (3) Improving four irrigation projects along the Fen Ho as follows—Tung Li, Hsiang Ling, Chiangchow and Hotsin.

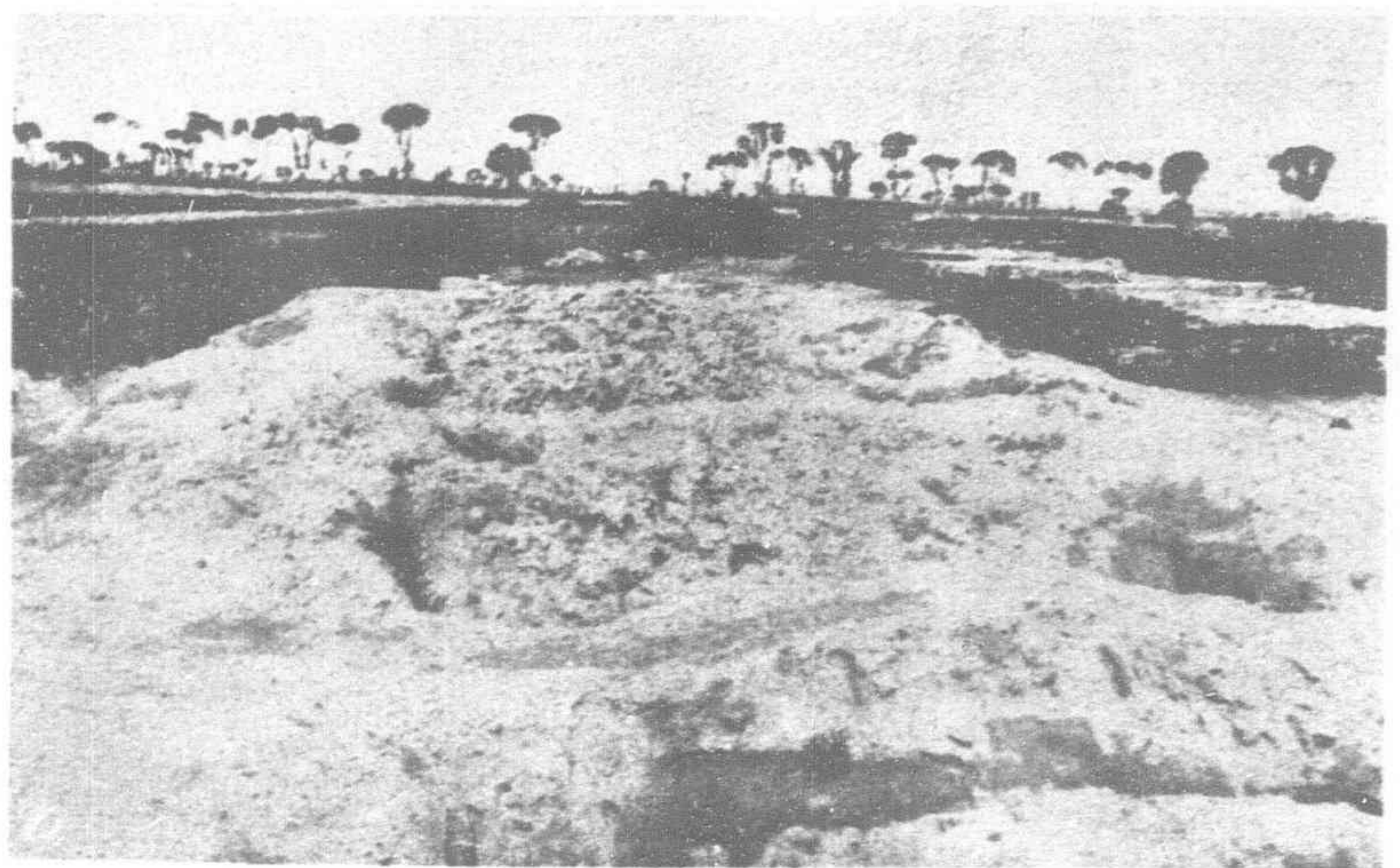
- (4) Straightening the Fen Ho channel between Taiyuanfu and I Tang—a 70 mile stretch—and building two sets of dikes uniformly spaced and with stone protection to the inner dikes.
- (5) Improving the Wen Yu Ho in its lower stretches as a means of flood protection to the Taiyuan plain.

Storage of Water on the Upper Fen Ho

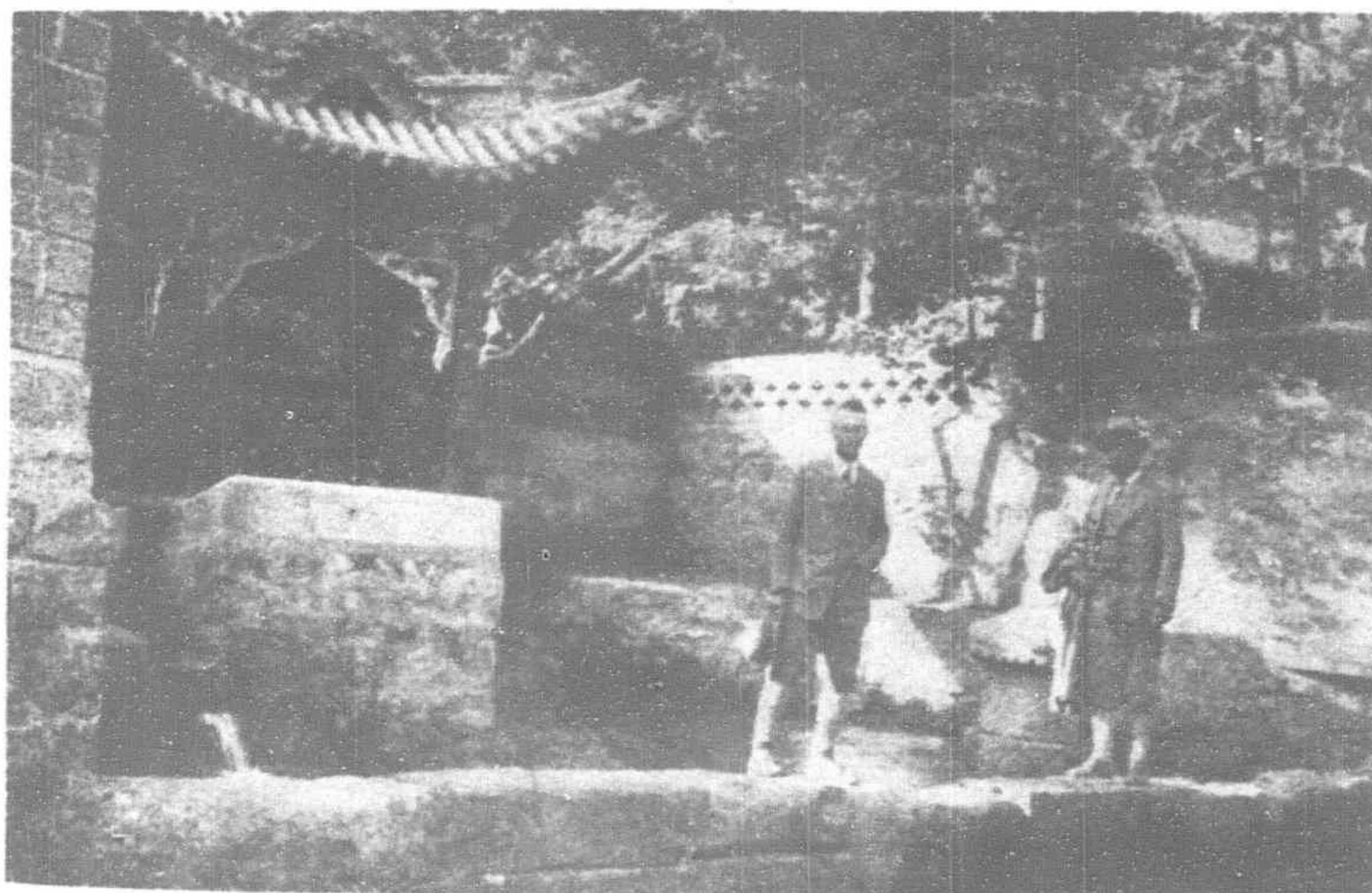
The drawings and capacity tables attached to this report indicate that the Hsiachingyiu reservoir has the greatest possibilities for economical storage of all those found along the Fen Ho or its feeders. The dam site is similar in width to the one 17 miles



Typical Stone Masonry Weir for Bi-Passing flood water at intake of irrigation canal in North Shansi



Where the Fenchowfu-Pingyao Road formerly crossed the Fen Ho. River broke to the North leaving bridge useless and channel silted full, July, 1934



At Chintze Springs



The Dam Site on Upper Fen Ho at Hsiachingyiu



A Good Dam Site on the Wen Yu Ho just above Cha Kou



Sand Boils in the Fen Ho East of Wenshui

down river at Lochiachu, but storage is much greater for the same height of dam at the upper site. A site once proposed just above Lantsun offers such poor storage facilities that it has not been seriously considered in this connection.

Since in flood periods in August the silt content has been found to be as great as 23 per cent by weight, the sluice gates in the dam will be open in summer so that the reservoir will act only as a very temporary detention basin smoothing out the flood wave after any unusual rain storm. Storage for irrigation purposes will not be in before late October when the silt content is but 1 per cent by weight or even less. It will then continue through the winter until the reservoir is filled.

It is planned to use this stored water over a period of 90 days from mid-March to mid-June supplementing the ordinary spring

flow of the Fen Ho which is from 100 second-feet to 150 second-feet at Taiyuanfu. The stored water will supply an additional 300 second-feet through the spring and early summer. Not all of this will be used in the Taiyuan plain but a portion will pass farther downstream to the Tung Li district or other lands still farther south.

This stored water will supply irrigation one foot in depth to nearly 325,000 mou of land and the annual revenue from this should be \$300,000.00 above all costs of operation.

This reservoir will flood considerable waste river bottom that is not tilled due to sand, gravel and boulder deposits. The farming lands it will flood in winter and spring are not of great value. Very few houses will have to be removed. Those who have rafted timbers down the river will be accommodated at certain periods



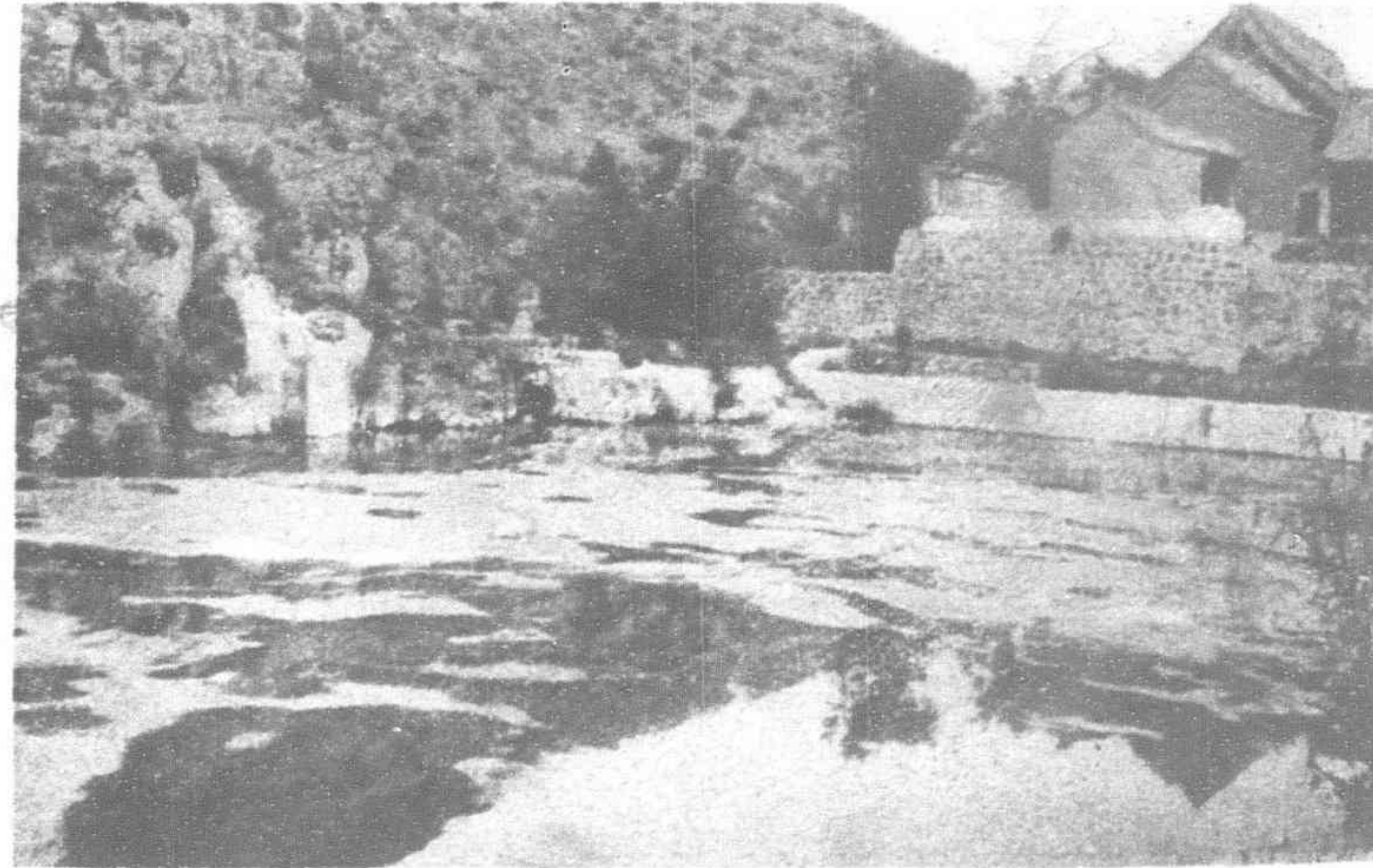
Millet Harvest near Lantsun



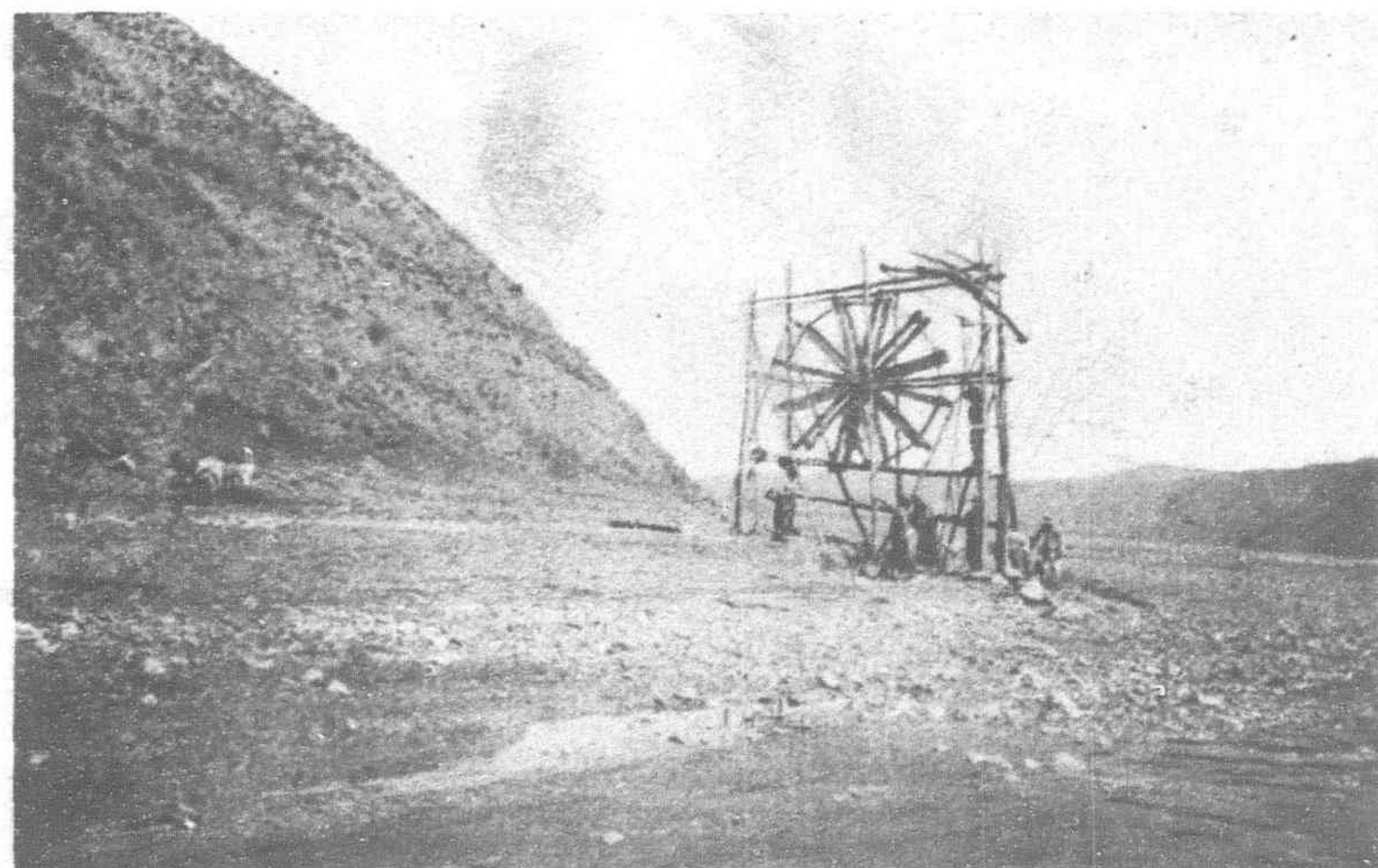
Along the Fen Ho near Lingshih, September, 1933



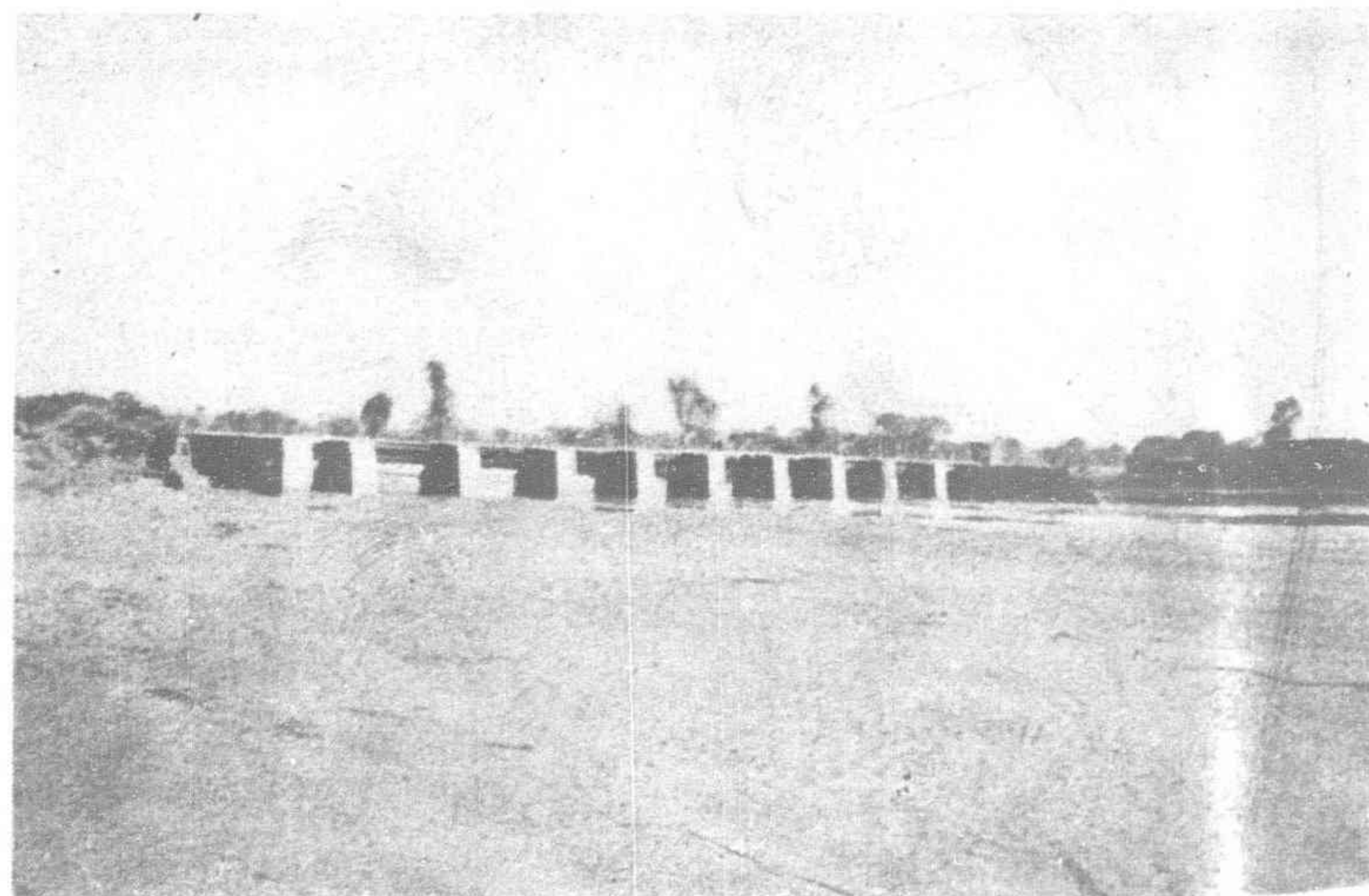
Along the Wen Yu Ho



The Lantsun Spring 40 li North of Taiyuanfu



Drilling for bed rock at No. 2 Dam Site on Upper Fen Ho, 1933



Diversion Dam No. 1 on the Fen Ho 20 miles South of Taiyuanfu.
Built in 1930

PLATE VIII

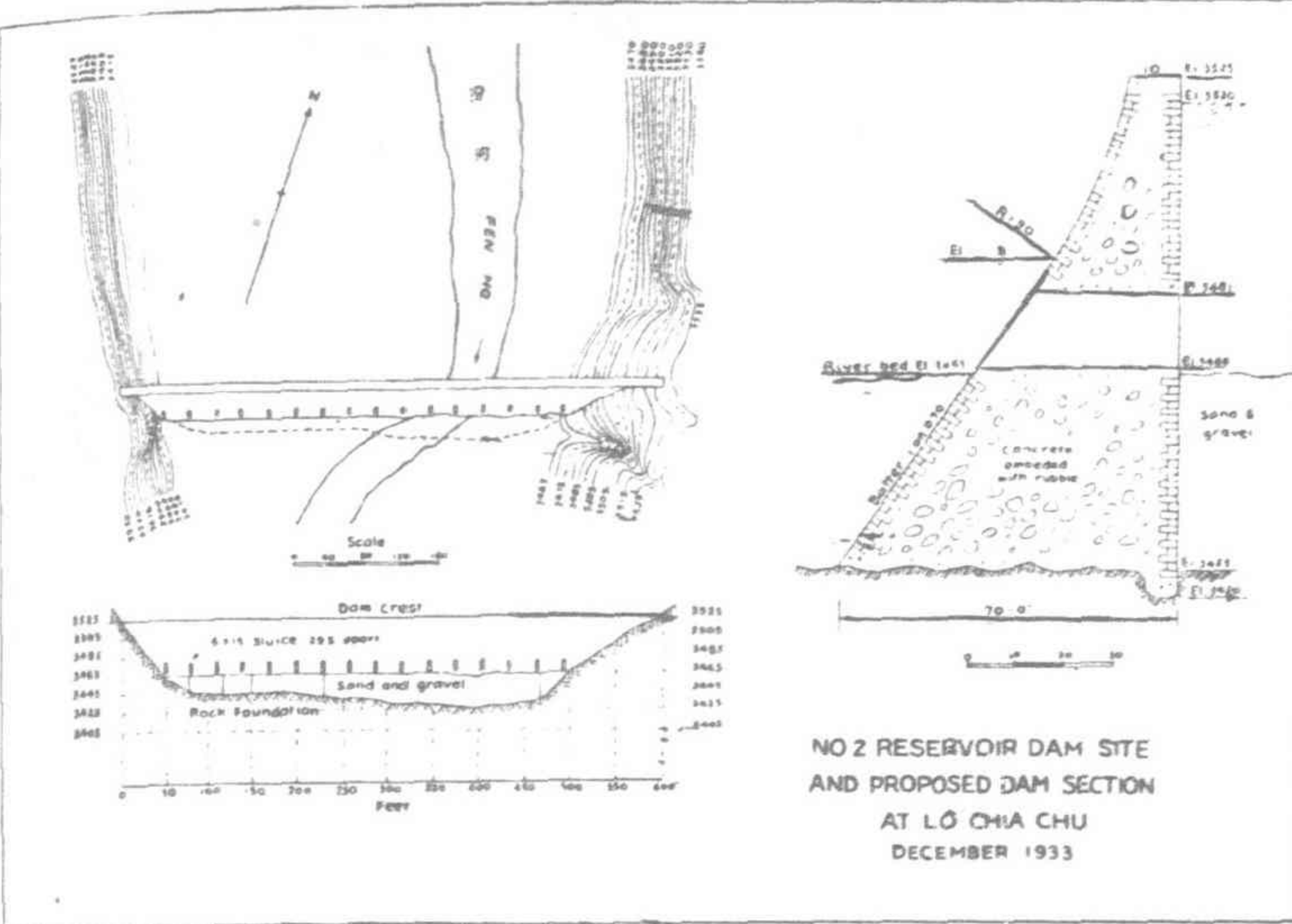
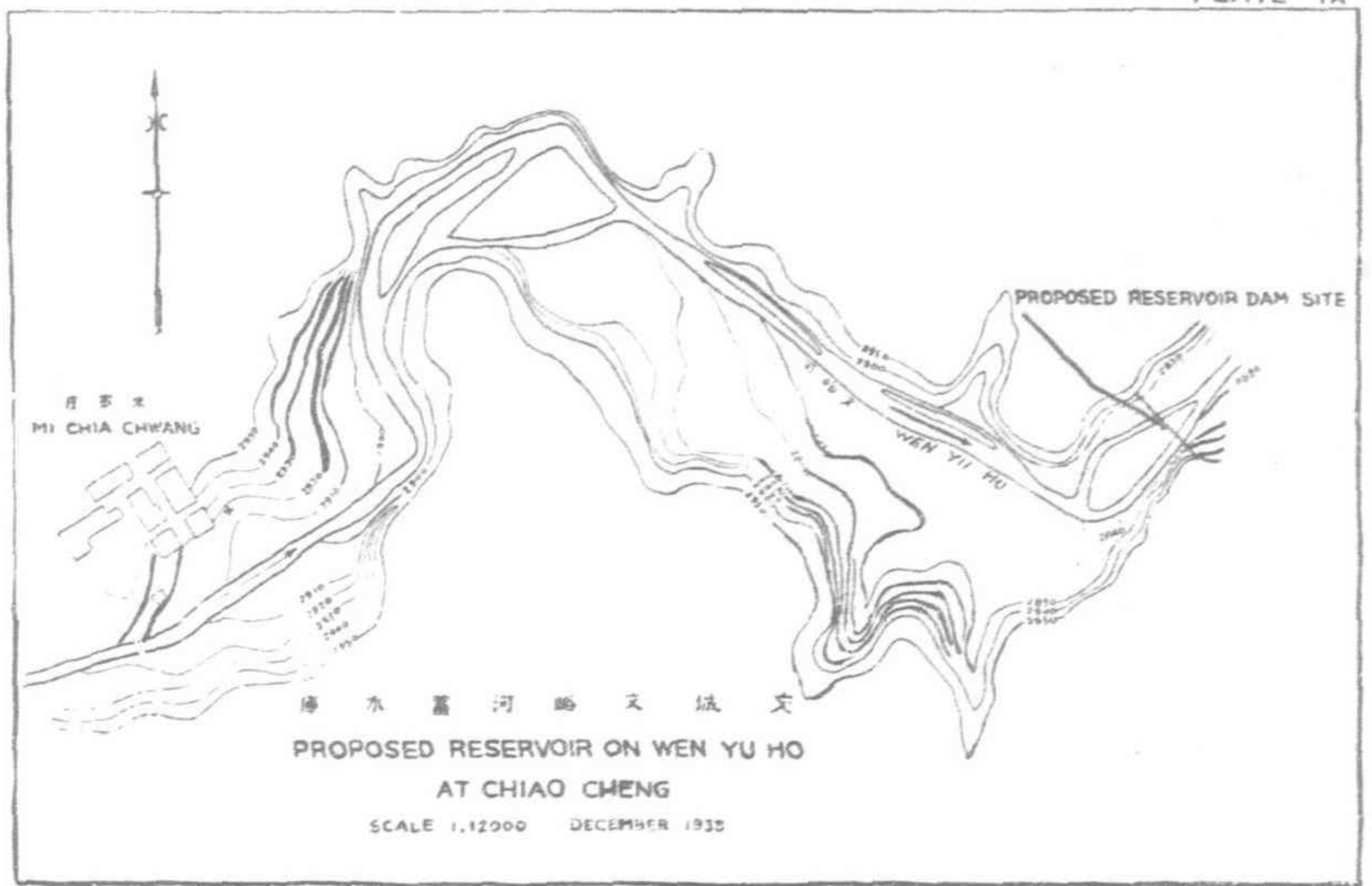


PLATE IX



of the year when logs and poles will be passed through the dam where gates and chutes are to be provided. Under suitable regulations the transport of timber down the Fen Ho may continue from the forests north of Chinlo to Taiyuanfu.

Reservoirs for Three Large Springs

If conservancy is to be practised in its truest sense in Shansi, then winter flow from these major springs must be stored for use in spring and early summer irrigation. At present little irrigation is done in the winter but a limited use of the water is found in running inefficient, old-fashioned, native mills for grinding flour or grinding bark into powder for incense. This winter flow is not being converted to its highest use. It is therefore wise to set aside certain days of the month for the use of these mills until such time as they are combined or replaced by a community steam plant. But in the near future reservoirs for holding this winter flow should be located so as to conserve the head that now is wasted in a series of low drops at these mills.

These reservoirs will be made by constructing earth dikes or walls packed in thin layers by hand. Their bottoms will be the sloping hillside where good earth is packed for the floor and sides to prevent leakage. The maximum depth of storage will be about 25 feet. They will be simply made and easily kept in repair, and fitted with masonry outlets and suitable gates for regulating discharge into irrigation ditches below. The immediate territory will have first claim on the water from these reservoirs at a fixed annual charge. Then other irrigation districts down river will have the opportunity to purchase the remaining stored water supply. This is on the assumption that special

contributions will be made toward building these by the territory that will be given the first benefits therefrom.

Improving Tung Li, Hsiang Ling, Chiangchow and Hotsin Irrigation Districts

For improving the Tung Li canal and the whole irrigation district close at hand with a total area of 75,000 mou, it is proposed to build a low masonry diversion dam across the Fen Ho and construct suitable headgates to give greater permanence to these intake works. Full details are being worked out for these improvements. Some soundings for foundations have been made at the proposed dam-site. Improvements to the distribution system will be worked out in 1934.

In late 1933 the sum of \$15,000.00 was loaned to each of the three districts having pumping plants in order to enable them to complete their canal systems. Part of this work was done in late 1933 by the districts concerned. These are the Hsiang Ling, Chiangchow and Hotsin. But still further improvements are necessary. Further protection is needed to keep the systems in order. The Fen Ho has damaged the Hsiang Ling system by washing away ground that formerly carried the main canal making it necessary to carry part of the canal through a brick lined tunnel. Clearly, stone river bank revetment work is needed here to control the Fen Ho.

As yet no migration of the Fen Ho has injured the pumping plant of the Chiangchow district but adequate river regulation is needed to insure this plant against flood attacks in case of a channel change immediately upstream. During 1933 the Hotsin pumping station sustained certain damages due to unusual floods from nearby tributaries

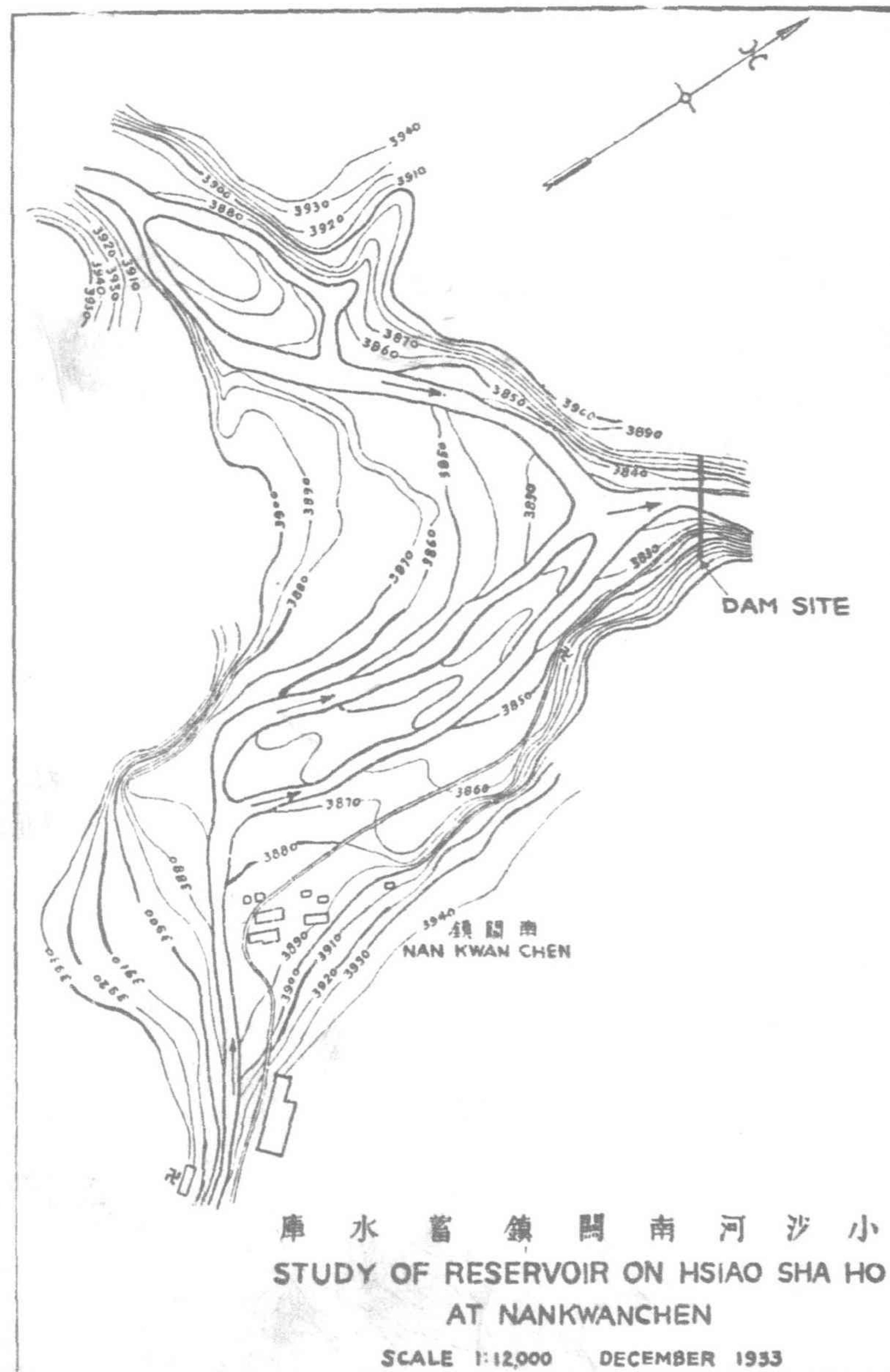


Plate X

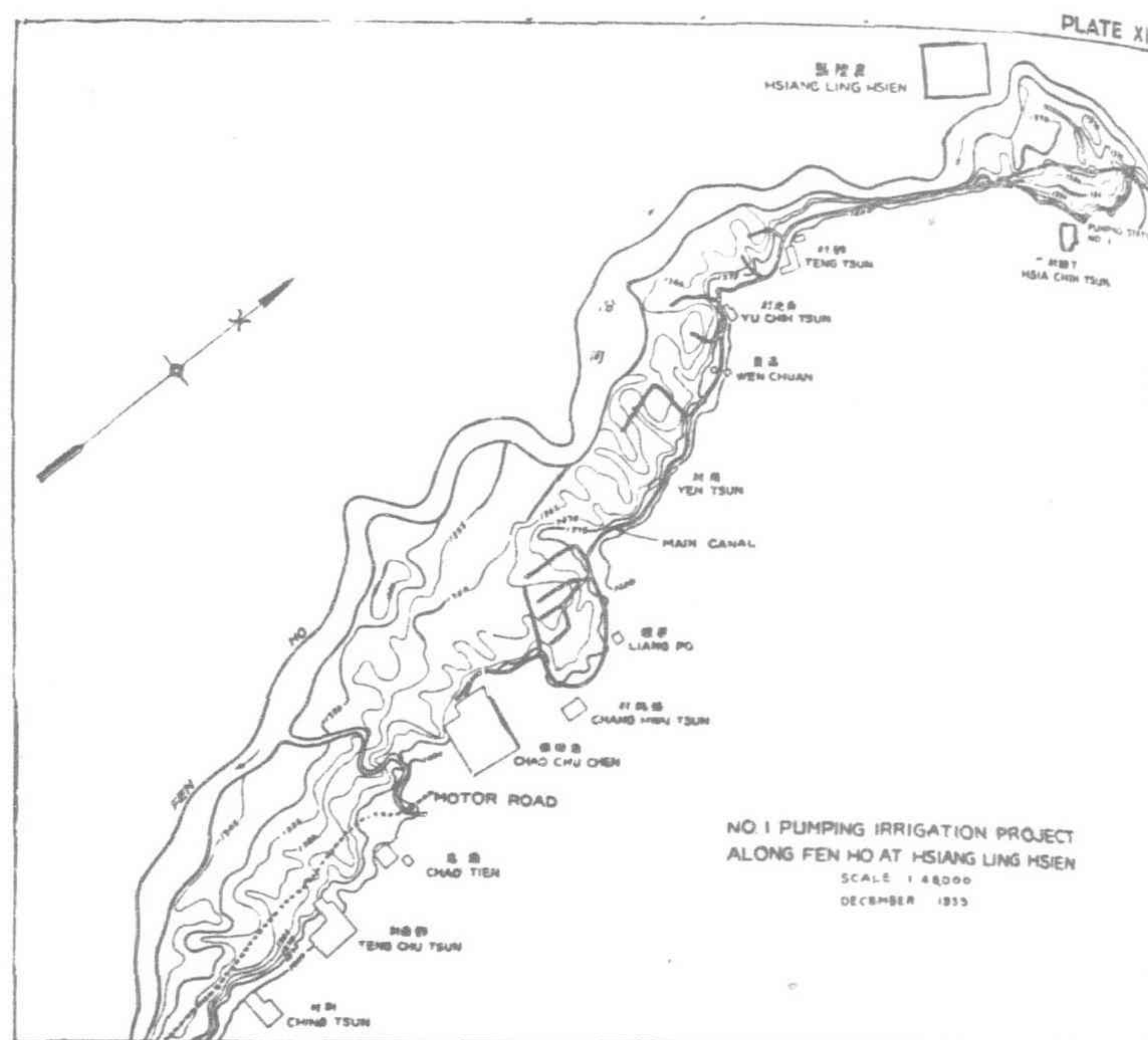
of the Fen Ho. Stone protective work is necessary to insure permanency of this pumping station and its inlet channel from the Fen Ho. Also further extensions of the distribution system are necessary to complete this system.

These four irrigation projects as now laid out will serve, with these improvements, the following areas of good river valley farm lands: Tung Li=75,000 mou, Hsiang Ling=18,000 mou, Chiangchow=33,000 mou, Hotsin=17,000 mou. These areas are taken from our 1933 surveys. Later improvements may permit moderate increases to these areas through service to adjoining lands especially in the case of the Tung Li canal.

A New Fixed Channel for the Fen Ho from Taiyuan to I Tang

Starting one mile above the motor road bridge at Taiyuanfu a new channel of uniform width between dikes should be built to a point below Chiehshu near I Tang at the lower end of the Taiyuan plain. This will be approximately 70 miles in length and be a series of tangents that will eliminate all sharp bends. Where the river has a suitable location this will be maintained. Otherwise the alignment will be altered by digging a new leading channel with capacity for low water flow up to 1,600 second-feet from which it may cut to both sides and find a medium and flood water channel between the two stone protected inner dikes centered 500 feet apart. The average depth of excavation for this channel will be seven feet.

Before scour takes place a medium flood flow up to 9,000 second-feet can be carried between the inner dikes. With scour widening the channel to seven feet of depth below the plain a discharge of 30,000 second-feet can be carried between the inner dikes leaving a freeboard of nearly three feet. Probably the river at this stage will dig a channel deep enough to carry a flow of 40,000 to 50,000 second-feet within these stone faced inner dikes. However, as a safeguard a set of outer dikes is to be built of similar section and height to the inner dikes. These are to be 1,500 feet distant from the inner dikes. This space between the inner and outer dikes will take extreme flood flows as they are allowed to pass into these outer channels through masonry weirs in the inner dikes. Figuring on a possible flow five feet in depth these two outer channels will



carry a flow of 50,000 second-feet, thus bringing the entire channel capacity up to 80,000 second-feet with a free-board of three feet on all dikes. One of these outer channels may be operated at a time using the other only when the flood becomes abnormal and all three channels are required.

This device will definitely regulate floods in the Taiyuan plain as far as the Fen Ho proper is concerned. Suitable diking to principal feeders such as the Sha Ho, the Hsiao Sha Ho and the Wen Yu Ho must be arranged for by the local districts concerned, though some provision is made in this plan to regulate the Wen Yu Ho.

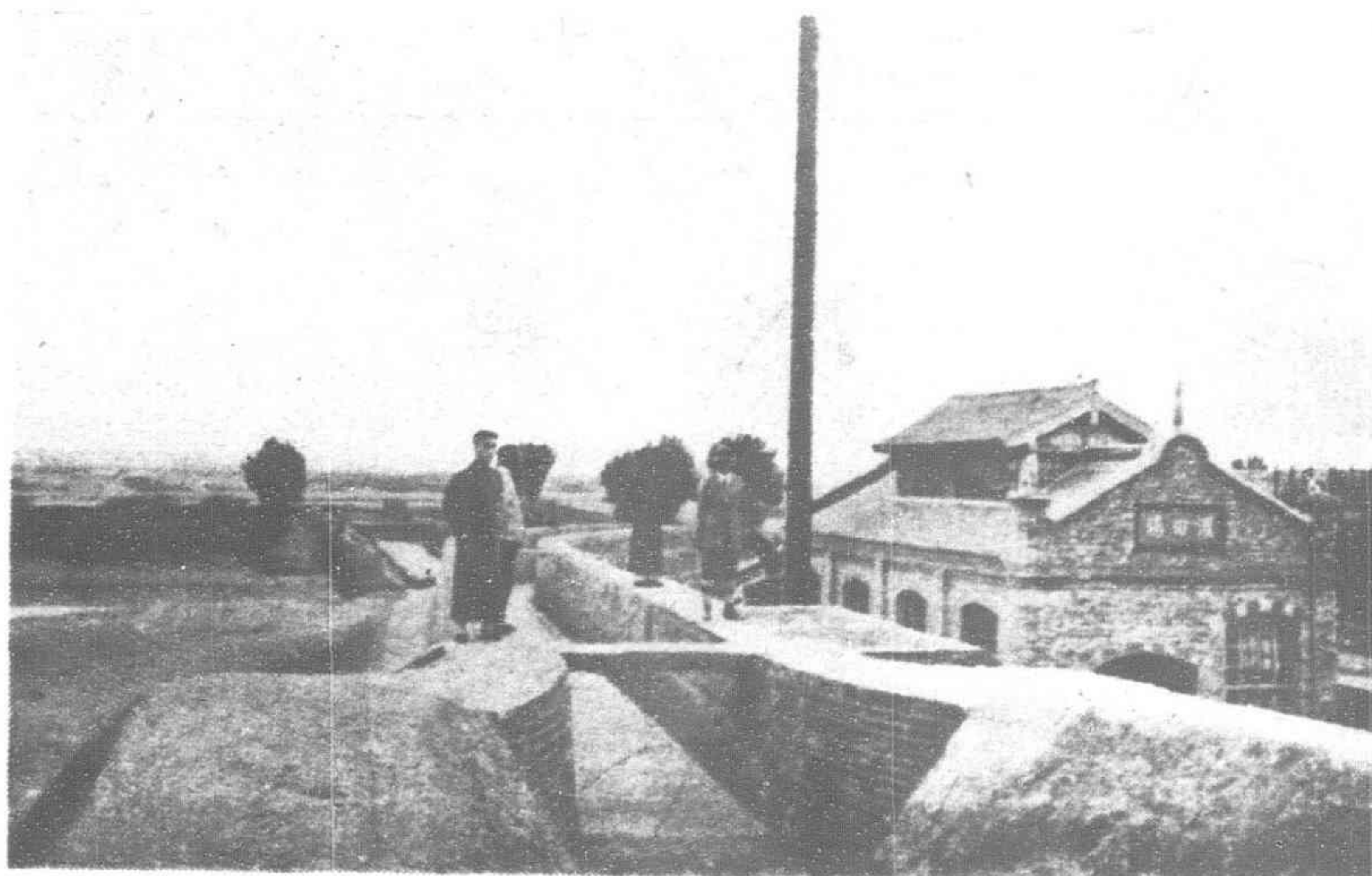
The earthwork required for the leading channel herein recommended will all be done by hand. The stone for facing the inner dikes should be quarried close to the river near Lantsun

using both hand drilling and machine methods. Then the transport should be by boat to the place of use.

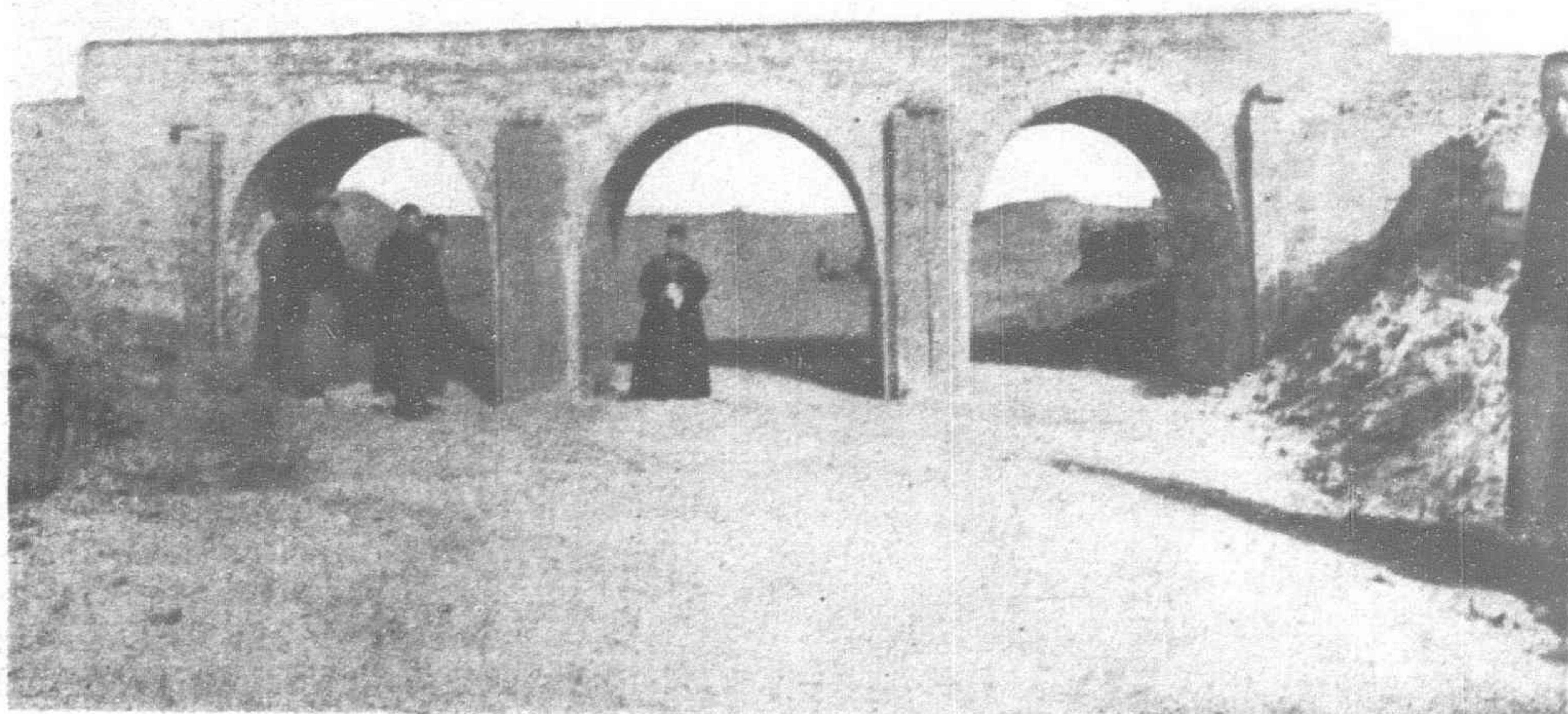
To carry out this river training work in the Taiyuan plain will take five years with 400 boats employed eight months each year hauling the stone. This is on the assumption that low draught native boats can be built to carry nearly two fang of stone per trip. If smaller craft must be used the time may be lengthened to ten years. Boats carrying one fang of stone or even less would seem to be more practical for this river.

Flood Protection Along the Wen Yu Ho

It is proposed to construct a low head dam about 15 miles west of the motor road near Cha K'ou on the Wen Yu Ho to retard flood waves that occur soon after heavy rains. These may be supplemented by low masonry retards just above the Kai Shan bridge in order to hold back gravel and boulders. To the west of the motor road this river keeps to a regular course but to the east it is necessary to improve the dike system. It is proposed to build a short-cut flood channel directly to the Fen Ho with a masonry weir constructed on the left bank of the Wen Yu Ho a few miles south-east of Kai Shan. This



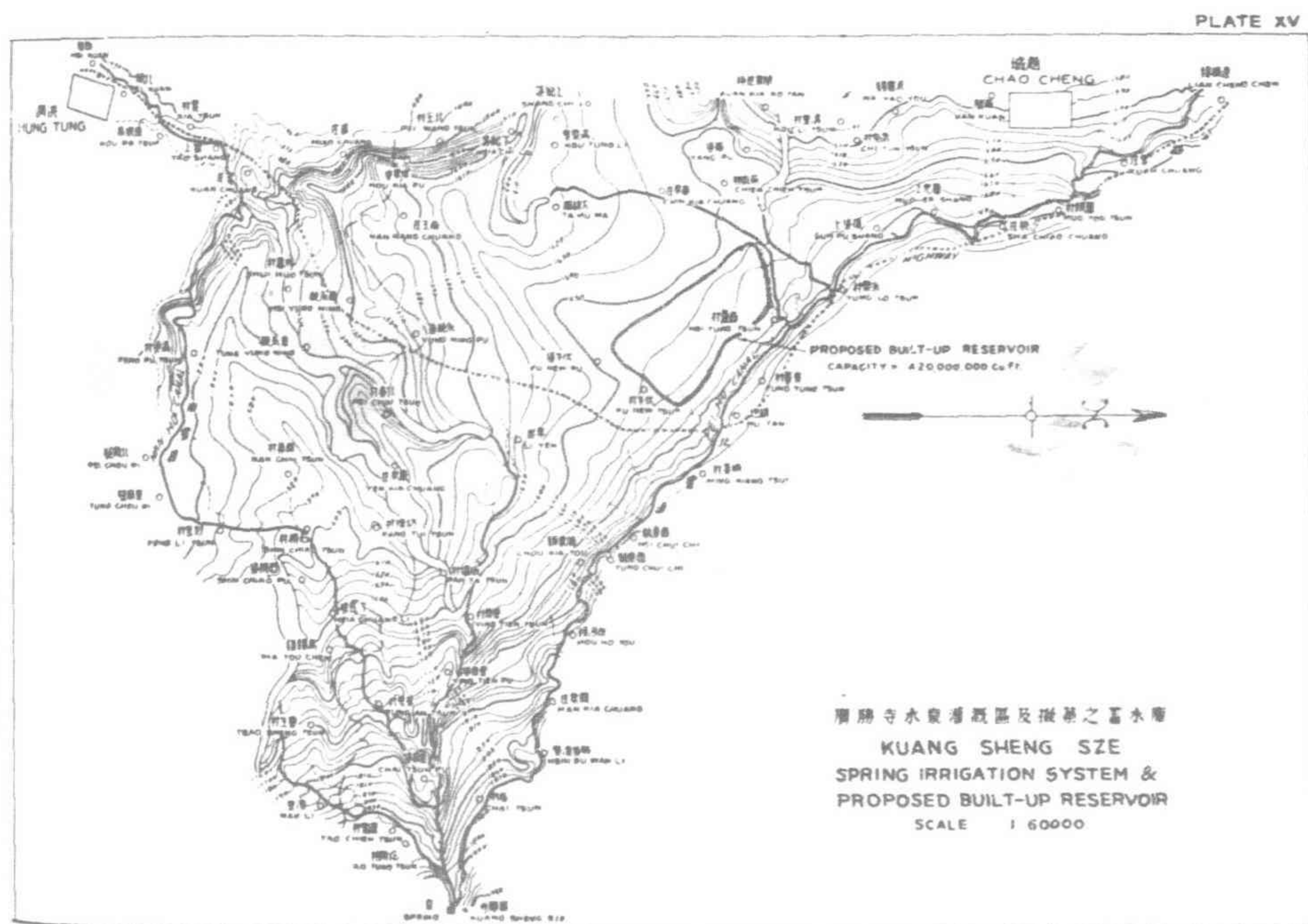
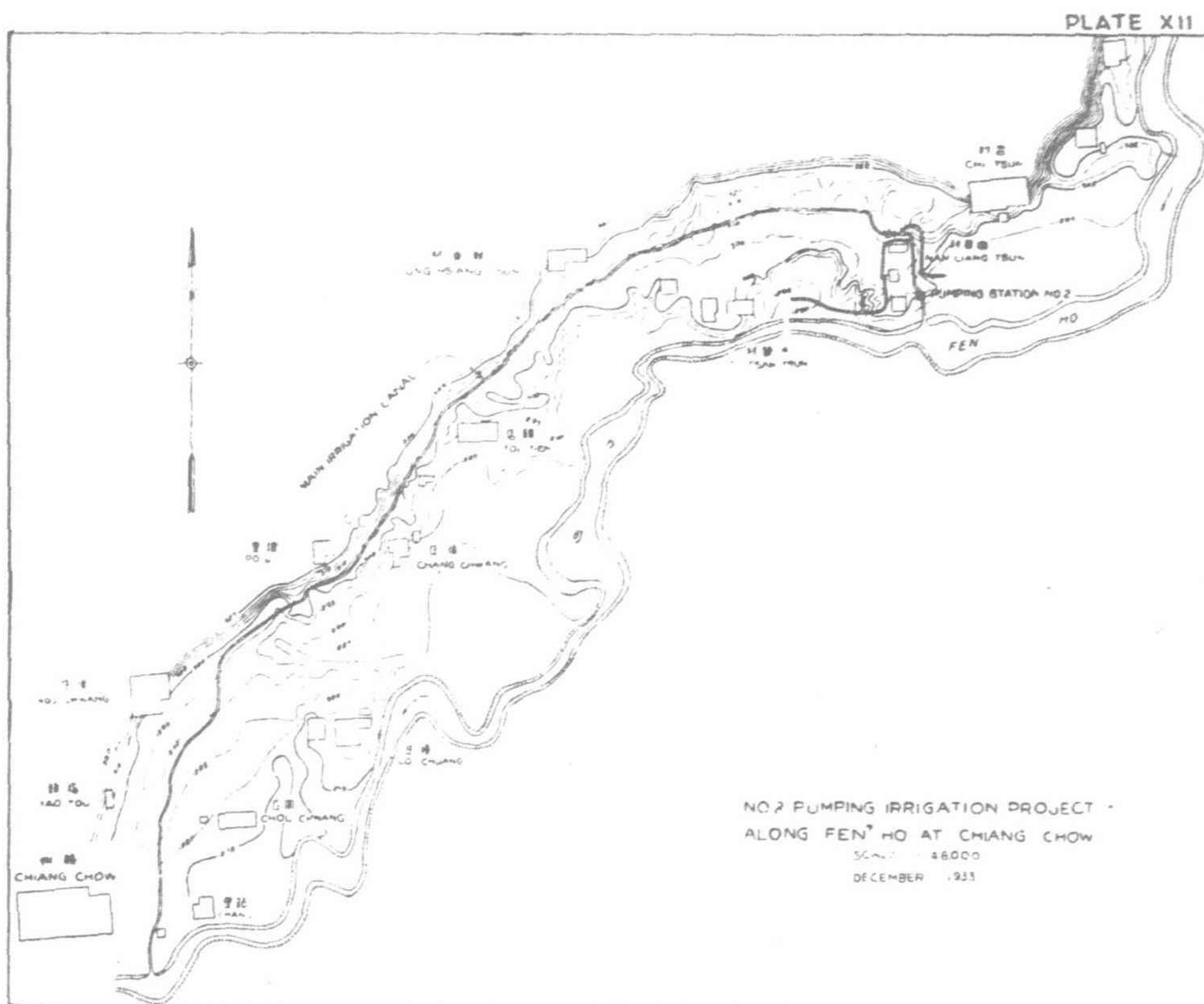
Pumping plant 35 li North of Chiangchow



Intake Gates to Main Irrigation Canal at Fen Ho Diversion Dam No. 2

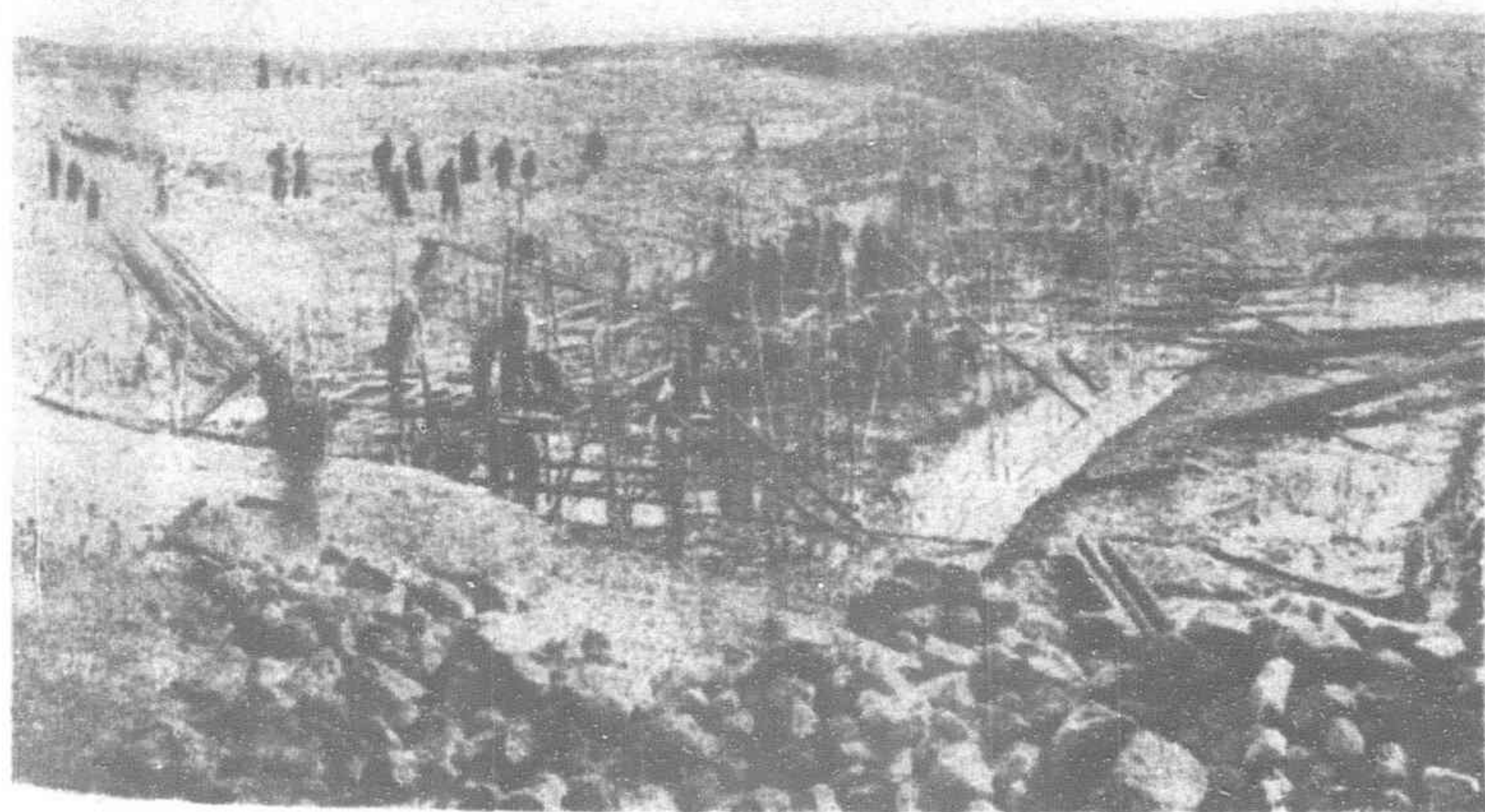
These improvements to the Wen Yu Ho are for the purpose of protecting valuable farm lands in the Taiyuan plain from floods that come down this tributary stream with great violence bringing deposits of sand, gravel and boulders that injure farm lands particularly in Wen Shui Hsien. Also lands in Fenyang Hsien are at times damaged by these floods. It is necessary that better flood protection be given these areas.

The following tentative figures are given in round numbers to form a basis for financing this work. Earthwork rates are based on our experiences with canal excavation on the Saratsi Irrigation Project in Suiyuan where the wage scale is similar to that in central Shansi and food prices are equally low. The costs of stone work are much lower than have been paid in getting supplies for Diversion dams No. 1 and No. 3 near Chingyuan and Pingyao where cart haulage was adopted. On this work the large amount of stone work warrants entirely new methods of transport. It is thought that the rate of \$25.00



It is assumed in all of this work that the Province will to a great extent regulate wages and appraise land damages so that the people who benefit by these improvements will participate in a way that will conserve the finances of the Province. Rigid supervision and economy is contemplated all through this work. Contractors' profits will be very moderate. It is only on this basis that these cost prices can be maintained.

(1) Dam on upper Fen Ho and land damage for storage reservoir ..	\$2,000,000.00
(2) Three reservoirs at three large springs	1,000,000.00
(3) Improving four irrigation projects along Fen Ho—Tung Li, Hsiang Ling, Chiangchow and Hotsin	500,000.00



A black and white photograph showing a flooded area. In the middle ground, several dark, rectangular objects, possibly shipping containers or small buildings, are partially submerged in the water. The foreground is dark and appears to be muddy or covered in debris. The background is a flat, open landscape under a bright sky.

No. 3 Diversion Dam on Fen Ho nearing completion. August, 1933

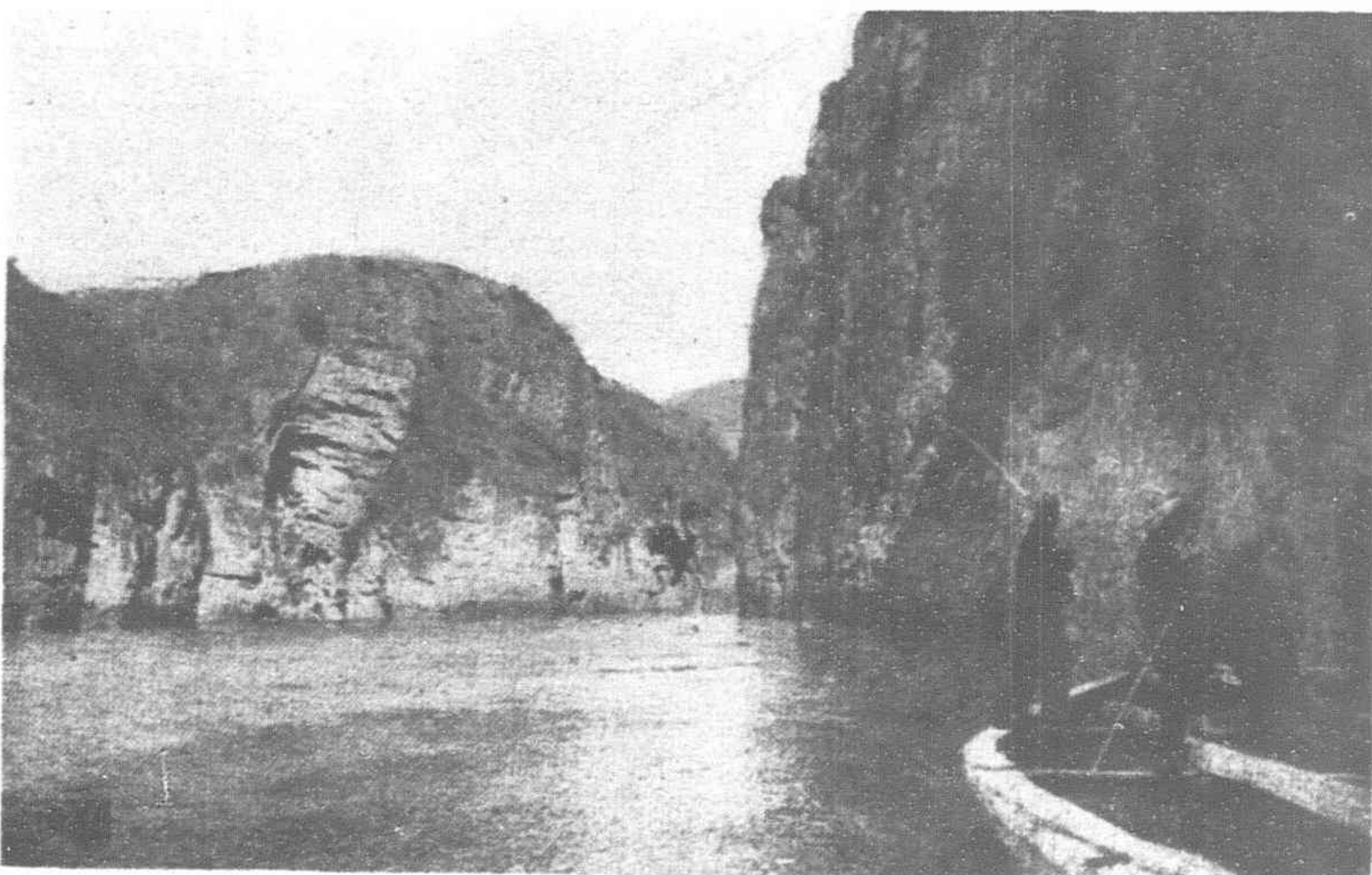
- | | |
|---|--------------|
| (4) Leading channel and inner earth dikes for Fen Ho from Taiyuanfu south 70 miles | \$550,000.00 |
| (5) Outer earth dikes for Fen Ho from Taiyuan south | 450,000.00 |
| (6) Stone facing of inner dikes of Fen Ho for 70 mile stretch. Continuous revetment work 1' x 30' = nearly 200,000 fangs at \$25.00 | 5,000,000.00 |
| (7) Wen Yu Ho improvements | 1,000,000.00 |
| (8) Connection roads to get to up-river reservoirs and large springs | 500,000.00 |

Total construction costs net	\$11,000,000.00
Contingency and special equipment at 10%	1,100,000.00
Engineering, general supervision and overhead 6%	660,000.00

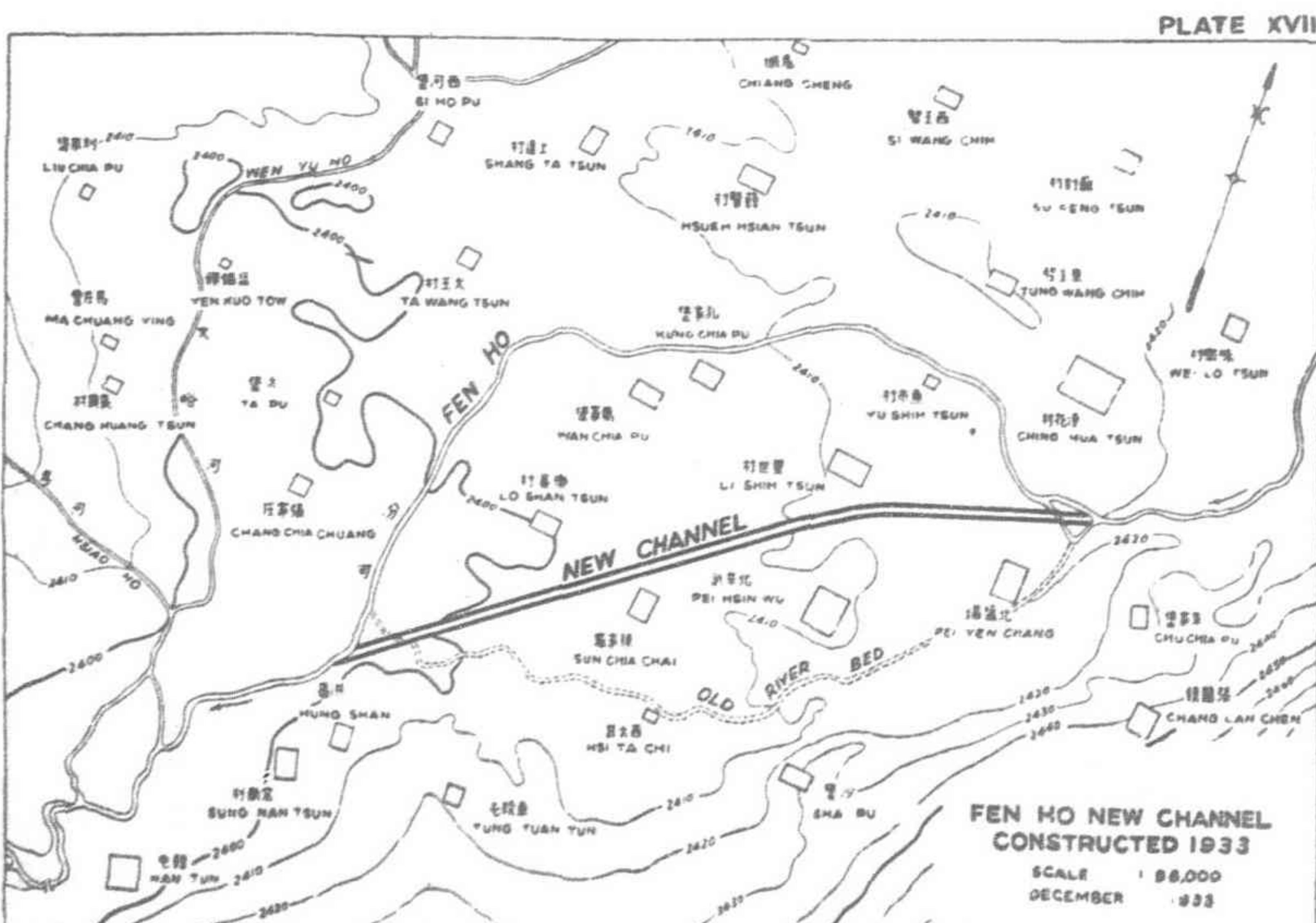
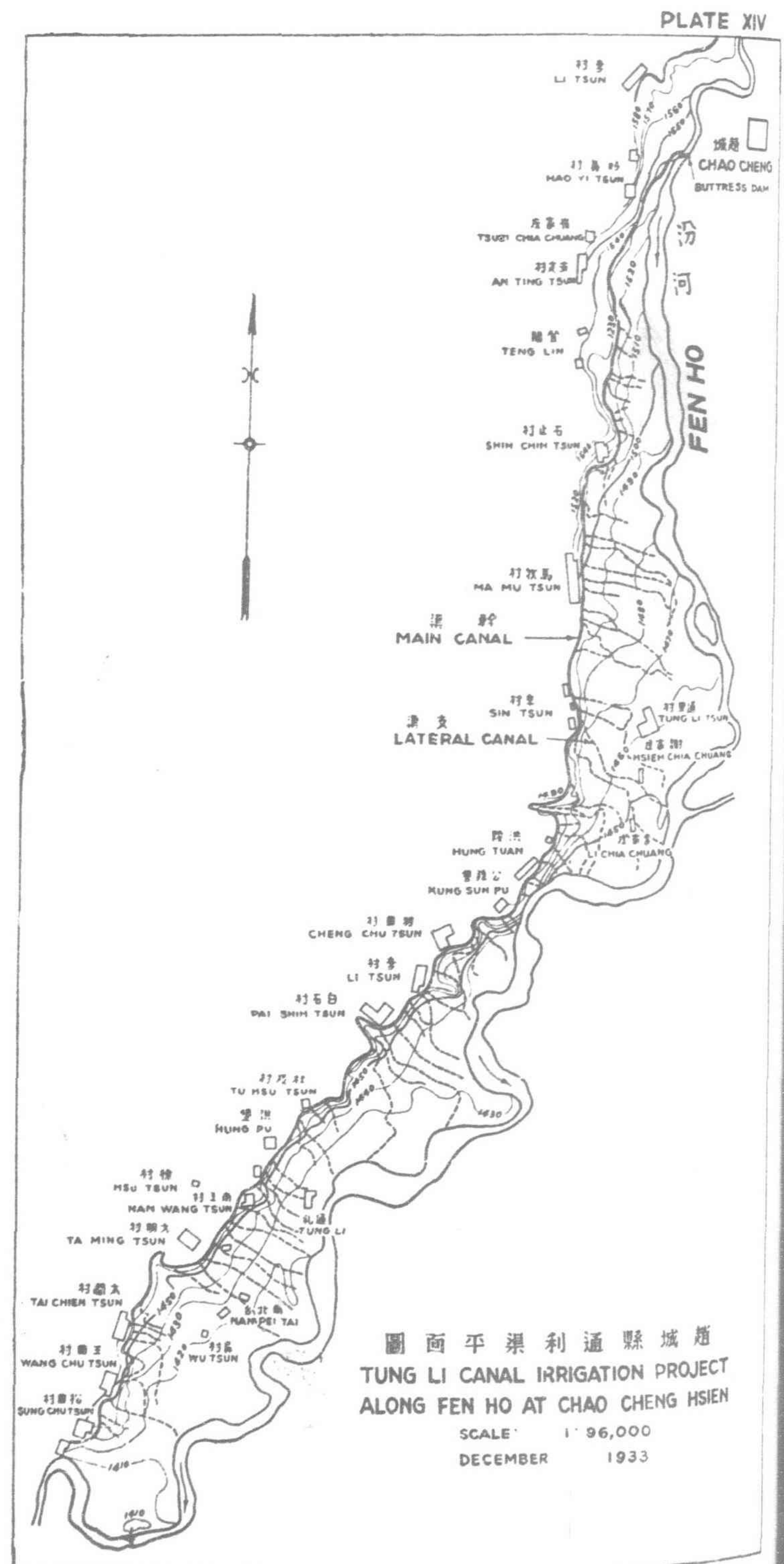
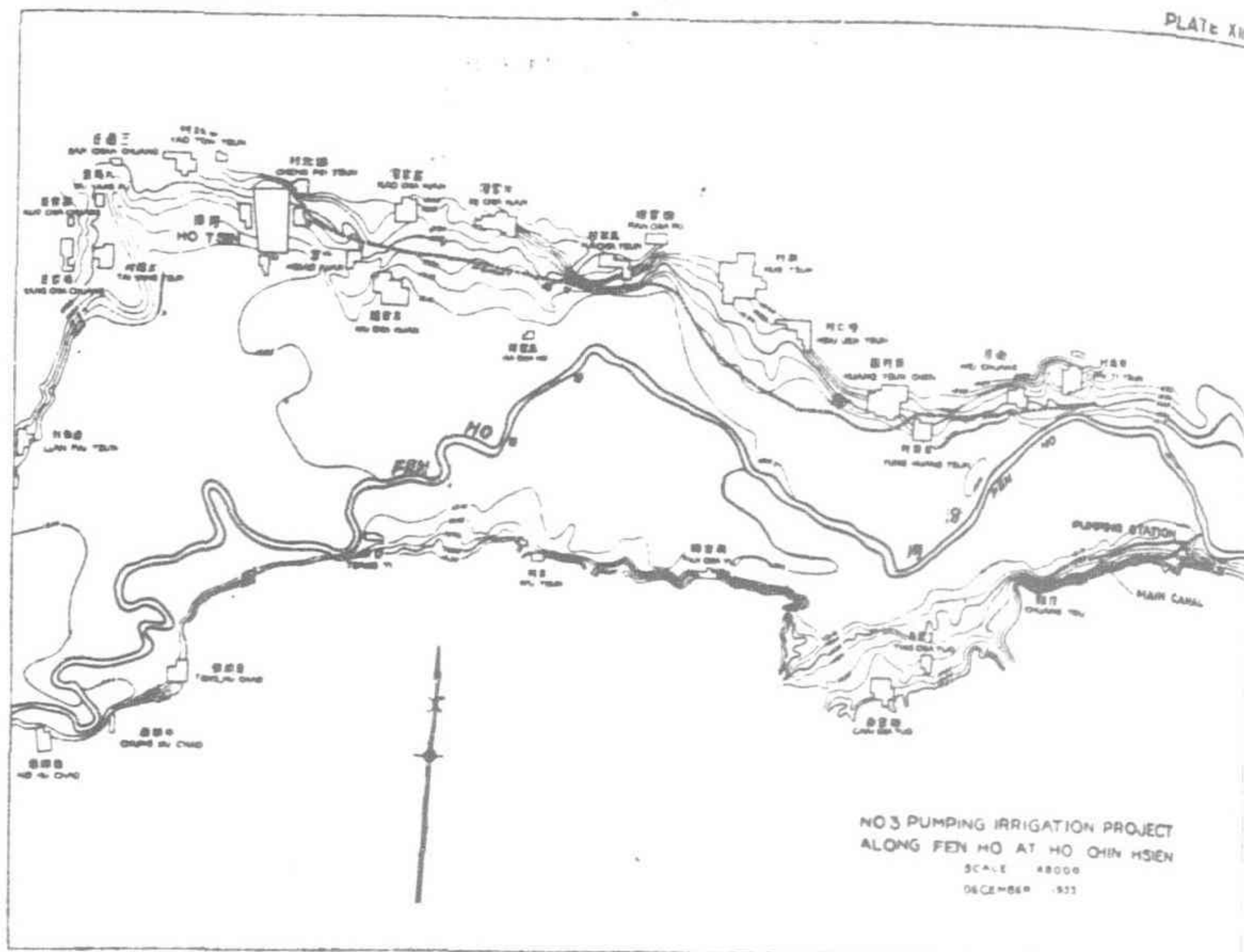
Grand Total for Five Year Plan \$12,760,000.00



Hauling an Autobus out of the Sha Ho at the Ford



Traveling Up the Gorges of the Yellow River North of Yumen'ou



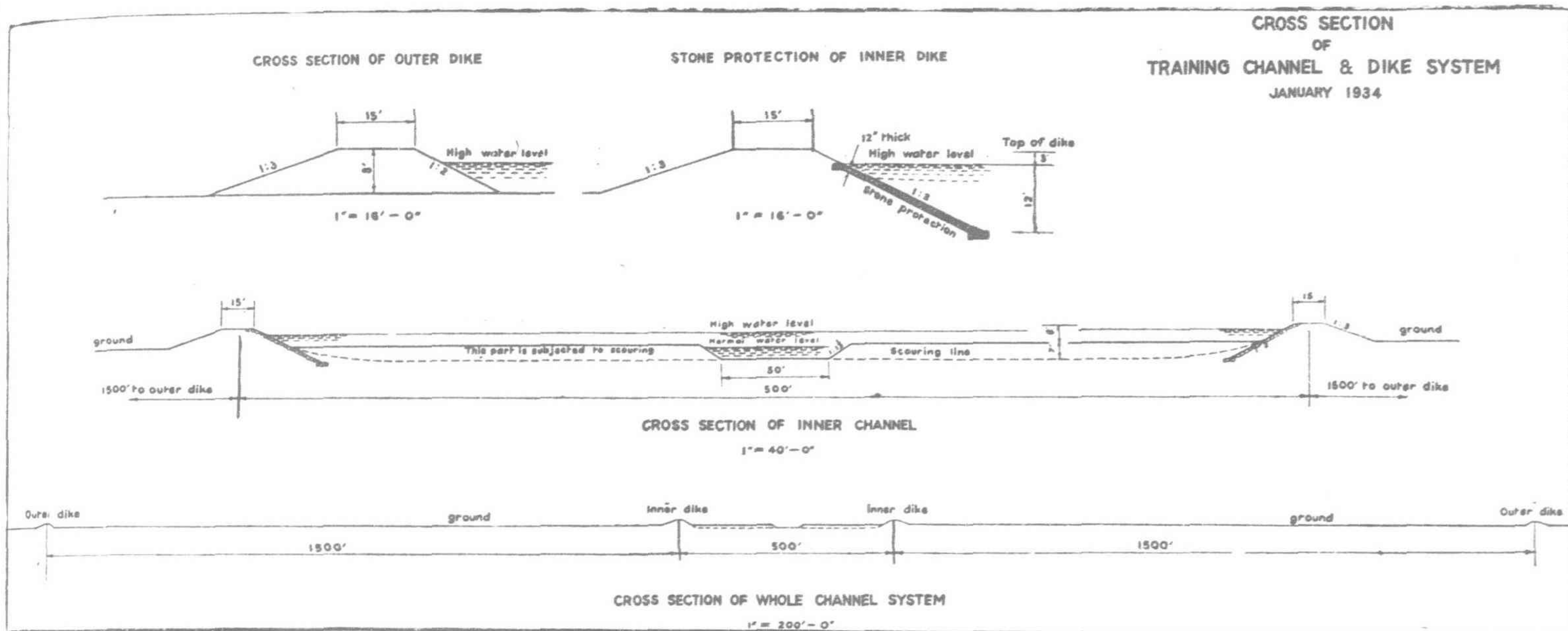


Plate XVIII

Note:—Two masonry spillways to handle excess floods flowing from inner channels to flood channels are included in above estimate for stone revetment work.

The inner dikes are figured on a basis of 30 cents per fang due to long haul and part wet digging. Outer dikes are estimated at 25 cents per fang.

The construction of the main river reservoir at Hsiachingyiu will take at least two years. At the same time the three reservoirs at the large springs may be built. Also improvements to the four irrigation projects at Tung Li, Hsiang Ling, Chiangchow and Hotsin may proceed the first year. The improvements to the Fen Ho channel for flood regulation may possibly be completed at a saving of \$1,000,000.00 below the estimate given herein depending on the ability of the Shansi River Conservancy Commission to get good co-operation of boat builders and boat men throughout the term of this work.

The Wen Yu Ho improvements as noted above are of such importance that they should be carried on simultaneously with the main Fen Ho channel improvements.

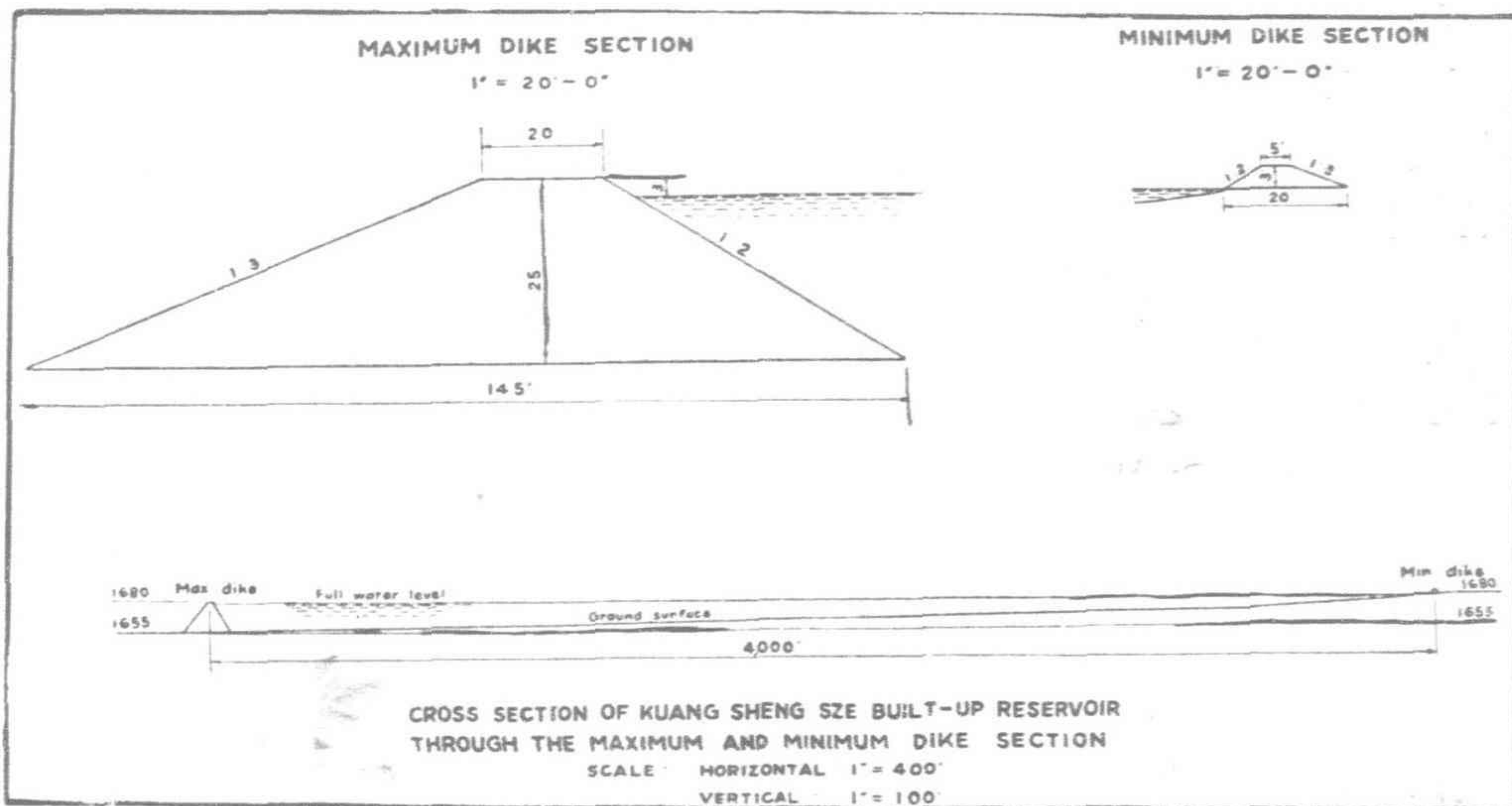


Plate XVI

Benefits to be Derived

In the matter of flood control it is proposed to spend slightly over \$8,000,000.00 including contingency and overhead over a period of five years or more. The benefits to be derived depend on the frequency of disastrous floods. Estimates of flood damages such as those of 1932 run from \$2,000,000.00 to \$5,000,000.00. If it is estimated that annual flood damages total over \$1,000,000.00 this work is well worth while for this is a most conservative estimate and does not include human lives. It is not only necessary to protect growing crops, buildings and other property, such as livestock, but human beings are entitled to a greater feeling of security than they now have while dwelling on the Taiyuan plain near the Fen Ho, as many are forced to live. The annual protection to property alone with its increased value as this insurance is applied should amount to \$2,000,000.00 annually. The increase in the value of farm lands in this area thus protected from flood will be enough to pay for the project by the time the work is completed. This is based on the assumption that of the 1,000 square miles or 4,000,000 mou of land in the Taiyuan plain at least 25 per cent will benefit markedly by these protective measures. Within a few years an increase of \$10.00 per mou on these bottom lands should occur, making a total of

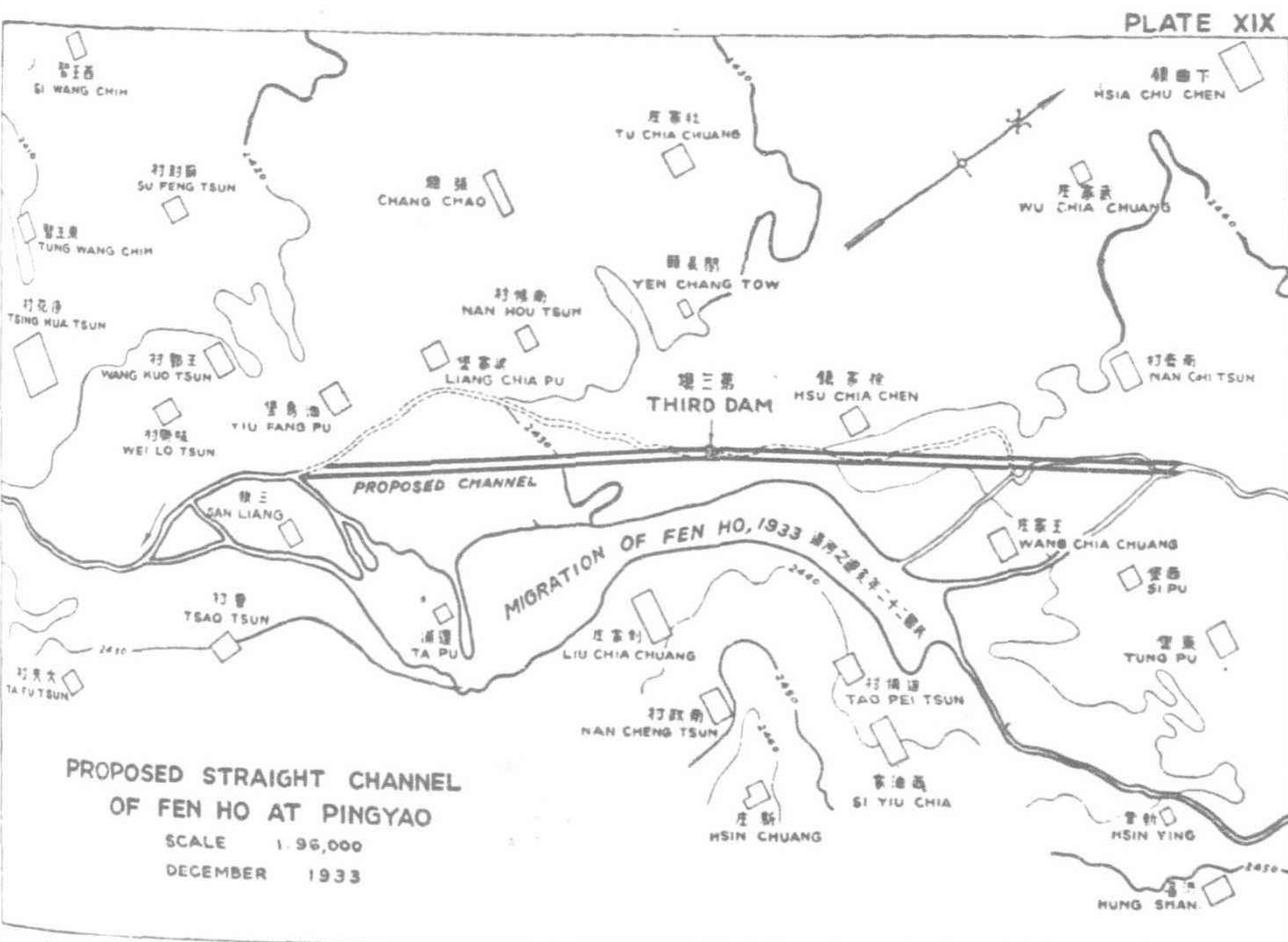


PLATE XIX

\$10,000,000.00 of unearned increment or values derived by benefits conferred by others than the land owners.

In the matter of irrigation it is proposed to expend something less than \$5,000,000.00 including contingency, supervision of construction and other overhead costs. The benefit to be gained should be an added 600 second-feet of flow for a period of three months in the spring and early summer. This is worth \$600,000.00 to the beneficiaries merely in the added crops they will normally produce on their lands. But there is also the item of increased land values arising from this insurance of a water supply in dry years. It stabilizes living and therefore makes lands and other property more valuable. On this score alone it seems probable that 1,000,000 mou of land will soon increase \$10.00 per mou in value making a total of \$10,000,000.00 in unearned increment that redounds to the benefit of the Province.

But aside from these tangible values arising from steadier crops and increased land values come those social values accruing from a feeling of security. To know that drought and flood hazards have, to a great degree, been removed is a most valuable factor in stabilization of rural life. This cannot be measured in dollars. Nevertheless it makes for happiness and an ordered state.

TANGIBLE BENEFITS

(1) Annual increase in crop values due to irrigation	\$ 600,000.00
(2) Annual saving in crops, buildings, livestock, etc. due to protection from flood	1,000,000.00
(3) Annual increase in land values for first five years due to irrigation improvements	2,000,000.00
(4) Annual increase in land values for first five years due to flood protection in Taiyuan plain	2,000,000.00
Total annual benefits during the first five years	\$5,600,000.00

These values indicate that this Plan can be made to pay with less than three years earnings provided a way is found to make the benefitted lands stand their share of the costs or to repay the

Province for these improvements that increase land values in a limited section—namely the Fen Ho valley. The revenue from water is placed at a very moderate rate. The water tax can well be more than \$1.00 per year per mou where one foot depth of irrigation is supplied. These lands are close to a good motor road and a new railway that carry the crops to markets near at hand.

Conclusion

These studies of 1933 in Shansi indicate that the Fen Ho Conservancy is a work of major importance. It is a practical undertaking for several reasons. A few of these may be enumerated.

(1) In these days China needs to develop areas of stabilized Government where a good start has been made toward peace and security of the ordinary citizen. Shansi is one of these areas with the greatest security and the best policing. Banditry within its borders is very rare.

(2) Climate and land fertility are such that the Fen Ho valley of Shansi is a good food producing region and well located to supply food by rail to other northern provinces.

(3) Shansi has fine scenery and therefore is a pleasant place for human beings to live. The natural surroundings are favorable for happy life of farming people.

(4) From a standpoint of profits from investment this program for improvement of the Fen Ho for flood prevention and for conserving waste stream flow for irrigation is sound.

(5) This project fits well into the larger Ten Year Plan that has been proposed for developing Shansi in many ways including better transportation, hydro-electric development, development of mineral resources, educational improvements, rural improvements of various kinds, and particularly extension of irrigation facilities.

(6) It is further practical because it can be carried out by steps over a period of five years or even more according to the finances that may be found available.

This Plan should be undertaken during 1934 and, under trustworthy management, be pushed to a successful conclusion as rapidly as funds and means can be found to carry forward the work. Its completion will mean much to the future of Shansi.

Aerodromes in Malaya

The long delayed aerodrome for Ipoh will, when it is completed, be only one among the 20 that the authorities hope to prepare during the course of the next two years.

It is believed that when the Assam Kumbang Aerodrome, Taiping, has been further developed it will rank among the finest in the Far East. The R.A.F. pilots, who recently landed there on their way from Iraq to Singapore on a flight designed to gain information about the route, are understood to have been very favorably impressed with the ground from a service point of view.

The program at present will give Perak during the next two years four grounds—Ipoh, Taiping, Teluk Anson and Sitiawan, whilst there is also land outside Gopeng on which planes have already landed and H.H. the Sultan's polo ground at Kuala Kangsar.

This unique aerial chain is to be brought about by the R.A.F. at Singapore in co-operation with the numerous civil and Governmental authorities. But for economic reasons, the chain would have been completed before now.

Some of the aerodromes are designed to be only emergency landing grounds but the aim is that the largest aircraft should be able to make use of them all. This particular point may be one that is retarding the work at Ipoh. It is understood that Government were urged to prepare a temporary ground, but contended that if money were to be spent at all the ground should fit in with all the R.A.F. and Imperial Airways requirements.

The establishment of this chain is considered to be of the utmost importance both to the military and to commercial flying.

The more important aerodromes in this chain will be Singapore, Malacca, Port Swettenham and/or Kuala Lumpur, 23rd mile south of Teluk Anson, Sitiawan, Taiping, Penang, and Alor Star.

Intermediate spots ear-marked are Skudai, Batu Pahat, Muar, Port Dickson, Seremban, Kuala Selangor, Telok Anson, Ipoh, Nibong Tibal, Sungei Patani and Padang Besar.

The R.A.F. have already surveyed the sites and the latest observations on some of them are of considerable interest.

The landing ground at Sungei Patani will be finished this month.

Tests carried out on the Penang aerodrome during the rainy season have proved that it is inclined to be soft, at such times, according to the *Free Press*. It is hoped this defect will be remedied by the time further tests are made.

At Nibong Tibal, part of the golf course has been ear-marked. It is only intended that planes shall land here in cases of extreme emergency.

The importance of Sitiawan is that it is on the coast and in bad weather aerodromes on the coast are easier to find than those inland.

It has been found difficult to find a good site at Teluk Anson on account of the soft surfaces in the vicinity and attention, meanwhile, is being directed more to the 23rd mile south of the town.

At Kuala Selangor the authorities contemplate making a run into the rubber country, but that proposal is still in the air.

Kuala Lumpur aerodrome is at the moment rather on the small side, but it is hoped to make it big enough to take all types of machines in the near future and work is already proceeding to this effect.

Conditioning the surface of the Port Swettenham aerodrome is not proving an easy matter—the same may be said of Muar—but improvements are being effected.

A provisional site has been selected at Port Dickson.

So far, Malacca only offers a strip on the golf course, but a better site is being sought.

Batu Pahat aerodrome, it is understood, has passed its trials and will be ready for use this month.—*Times of Malaya*.

The Kuznetsk Metallurgical Works*

By GHITA FARBMAN

DURING the time of the Allied military intervention, Lenin used to say that at the worst, it was always possible for the Bolsheviks to retire beyond the Urals, entrench themselves there and preserve the Soviet State, and it is very well-known that the Bolsheviks had for a long time had the exploitation of the Urals in mind. The first-hand acquaintance, with Siberia that most of them had gave them a pretty accurate idea of the riches of the Siberian plains. Krassin, the first Bolshevik Commissar of Trade repeatedly emphasized the necessity for developing the Ural region.

Even when Siberia had been chiefly a place of exile, it yet was looked upon as a sort of Promised Land. It was at the same time a nightmare and a legend of the Eldorado rich in precious metals, in coal, in rare and valuable furs, a country of illimitable forests, and wonderful fisheries, the country of plentiful and abundant meat and the cheapest and best wheat. And yet for centuries under the old régime it remained sparsely populated and its riches almost untapped. In old German guide books describing the riches of the Urals there is inevitably the statement that, had not the Urals and Siberia been owned by the Russians, towns and factories would long ago have covered the face of the land, exploiting its untold riches.

It is characteristically paradoxical that though Russian industry—and especially heavy industry—was actually started in the Urals as far back as the reign of Peter the Great, the great Siberian continent itself had up to the twentieth century, been left almost entirely untouched. In the nineties of the last century—the commencement of Capitalism in Russia—the Urals lived through their first period of prosperity, mostly under the influence of foreign concessionaires. That was the time of the boom in Kyshtym and Tagil copper on the English stock market. Yet even the amazing success of these first attempts at the exploitation of Siberian wealth was unable to tempt enterprise and capital further into the Siberian plain. As a matter of fact, it was during the war, when copper and other non-ferrous metals became particularly valuable that concessions in the Altai foothills were asked for and granted. But these concessions remained merely paper ones and hardly reached the stage of actual exploitation. Still, the English and American engineers and concessionaires, who were working or prospecting in Siberia, had obtained a good notion of the riches of the country.

When the time came for the restarting of the mines and other works stopped by the Revolution and the Civil War, it was the Bolsheviks, many of whom had been formerly Siberian exiles, who definitely refused to allow the concessionaires to re-establish their hold on the Urals. They were so imbued with the prospects of Siberian development that they succeeded in convincing the Government of the necessity of including Siberian development in its general plan.

In May, 1930, the foundation of the Uralo-Kuznetsk Coal and Steel Combine was resolved on. The Combine was to utilize the iron of the Magnet Mountain and the coal of the Kuzbas Coal field. The Kuznetsk steel works played very second fiddle indeed; it was

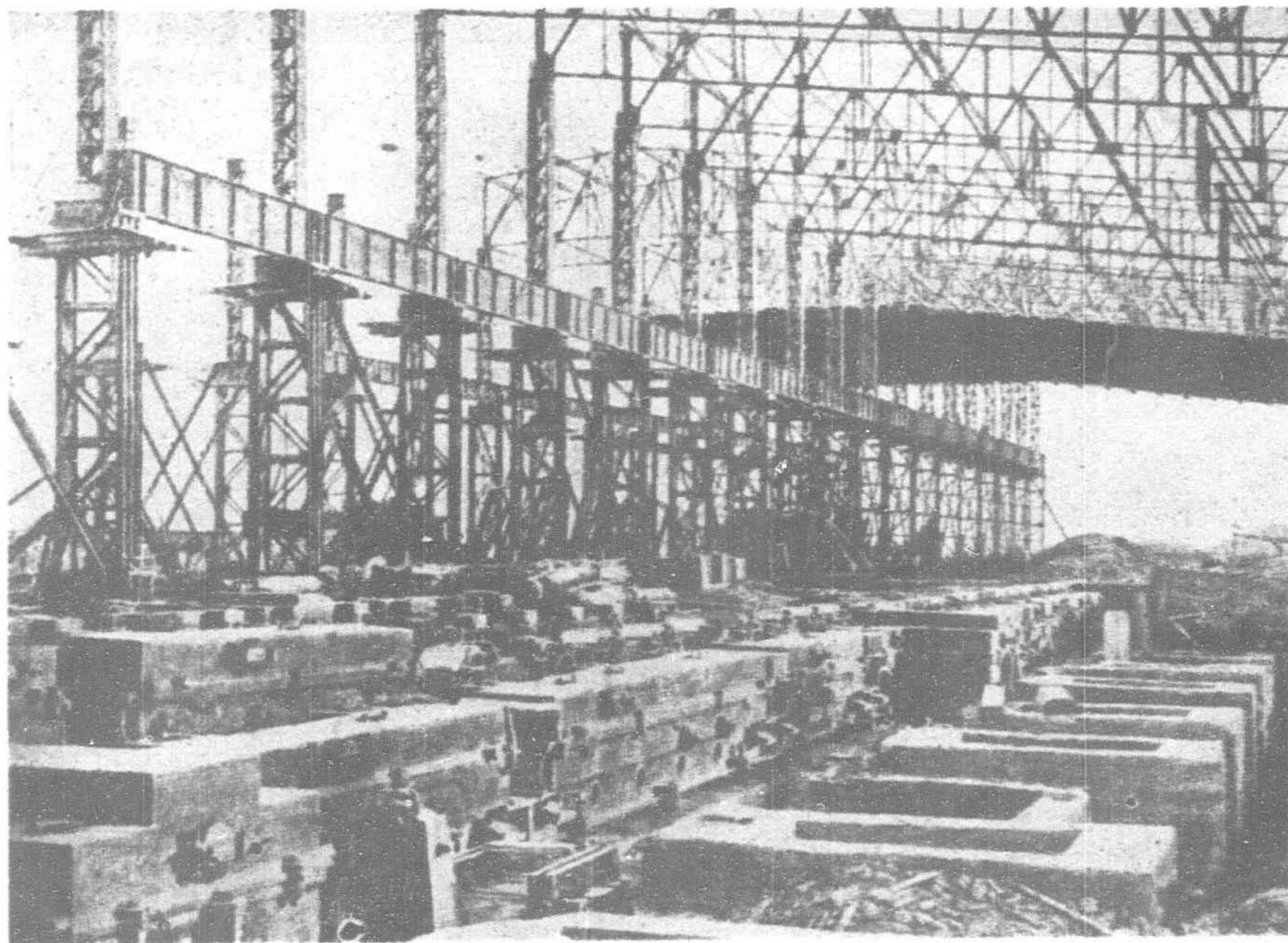
thought little more than a piece of clever economy to cut the impossibly high cost of transport of coal to the Urals, more than twenty-three hundred kilometers away, by building a second steel works on the coal field, working with Ural iron ore, and thus roughly halving the cost of transport. Kuznetsk was subsidiary in importance to Magnitogorsk not only because it was half its size but also in its functions—Magnitogorsk was emphatically the senior partner in the concern. The fact that Magnitogorsk was so much nearer to the center of things is largely responsible for the fact that in this, the first step to the industrialization of Western Siberia the extreme importance of the Kuznetsk works passed unnoticed. The monumental simplicity of an entire mountain of iron ore naturally tends to render insignificant even the world's greatest coal field. It was perhaps inevitable that Kuznetsk should in the beginning have been treated rather as the Cinderella of the Combine.

The site chosen for it was not a good one. Near the River Tom, in a circular valley surrounded by high downs, on marshy soil. It lies at one side of the circle, backing on to the downs, in such a position that the Upper Colony gets all the coke fumes. It is a thoroughly bad position—as though the works had been thrown down thoughtlessly and over-hastily. And yet, incongruous though a steel mill in a valley, that, but four years ago was famed for its wild-fowl, may sound, the mill seems an integral, necessary part of the scene. Instead of a violation of the rustic beauties, the mill seems the inevitable completion. That, indeed, is the general impression of the works. In spite of the uncomfortable conditions, Kuznetsk is being worked steadily towards a definite goal.

The difficulties are enormous, but it is these very difficulties that make Kuznetsk so important as the pioneer in Siberian industrialization. The main difficulties are those of transport, material and of workers.

Kuznetsk is about five thousand kilometers from Moscow and more than a day's journey from the Main Siberian railway line. This was of the utmost seriousness during the building of Kuznetsk—essential materials could be sent out from Moscow, but be delayed, sidetracked, lost. With every day it became clearer that it was emphatically not economic to work in absolute dependence from a center five thousand kilometers away. It became imperative that the essential materials for construction should be made available close at hand.

The main difficulty has however been that of workers, the lack of them and the lack of training of those available. While construction was going on it did not seem so very remarkable that it had been found possible to build so largely with such completely untrained hands as Siberian peasants. The really amazing part of the business began with the exploitation of the plant. Last year it seemed as though efficient work would be impossible, and yet the September daily average of pig-iron was 1,593 tons or 113.8 per cent of the plan (1,400 tons), and steel 1,141 tons, or 103.7 per cent of the plan (1,100 tons).—(Continued on page 235)



The rolling department at Kuznetsk. It is more than one kilometer in length

*British Russian Gazette and Trade Outlook,

Eight British-Built Locomotives and Tenders are Shipped to China*

EIGHT "Pacific"-type passenger locomotives and tenders have recently been constructed by the North British Locomotive Company, Limited, for the Tientsin-Pukow Railway, China, to the inspection of Messrs. Sandberg, the consulting engineers.

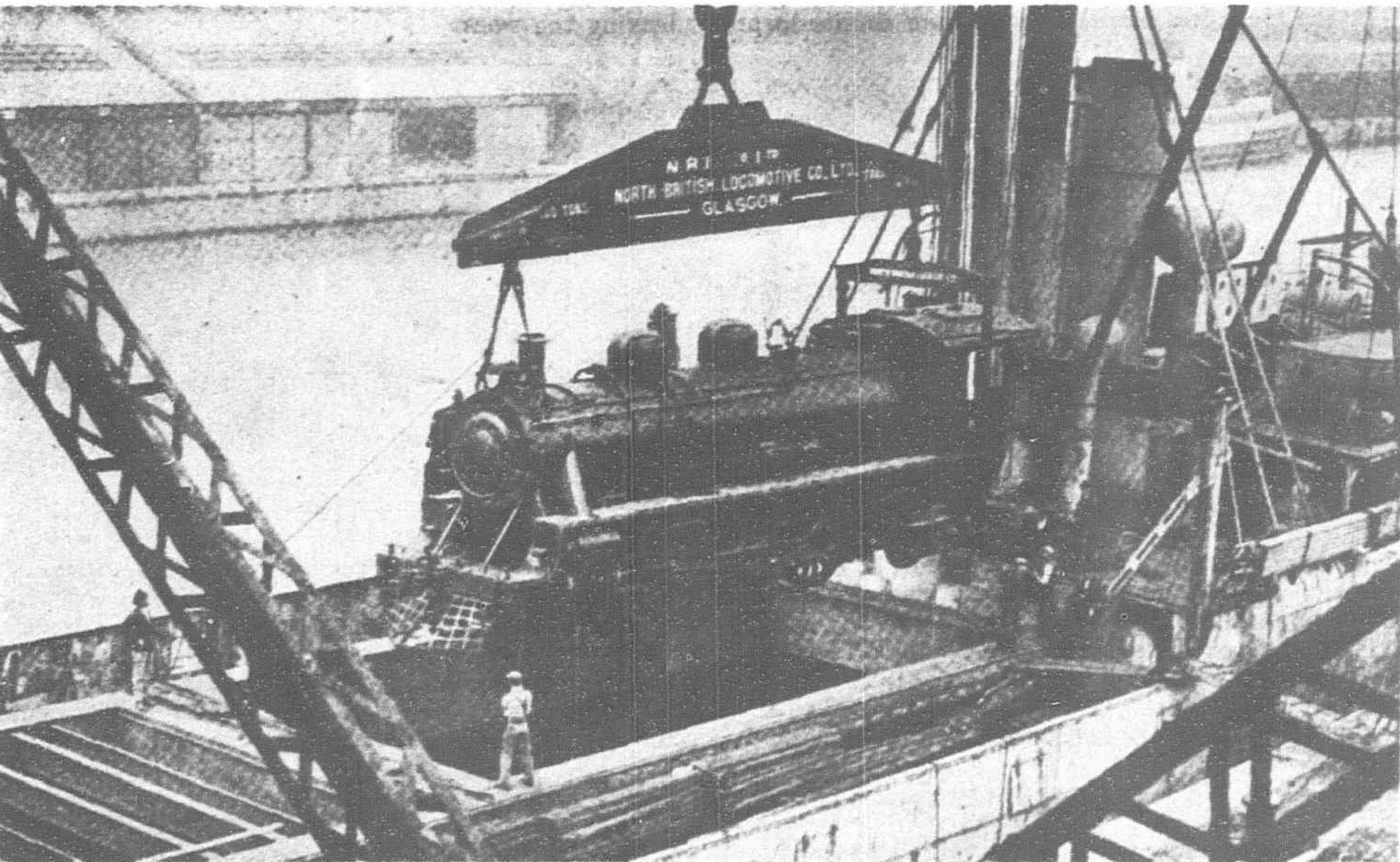
In the main features the engines are similar to previous locomotives built in America in 1920, and the contract was obtained after severe competition with American builders.

The order was placed with the North British Locomotive Company on December 15, 1932, and the engines were shipped, fully erected, on the m.v. *Beldis*, at Glasgow, and are now in commission.

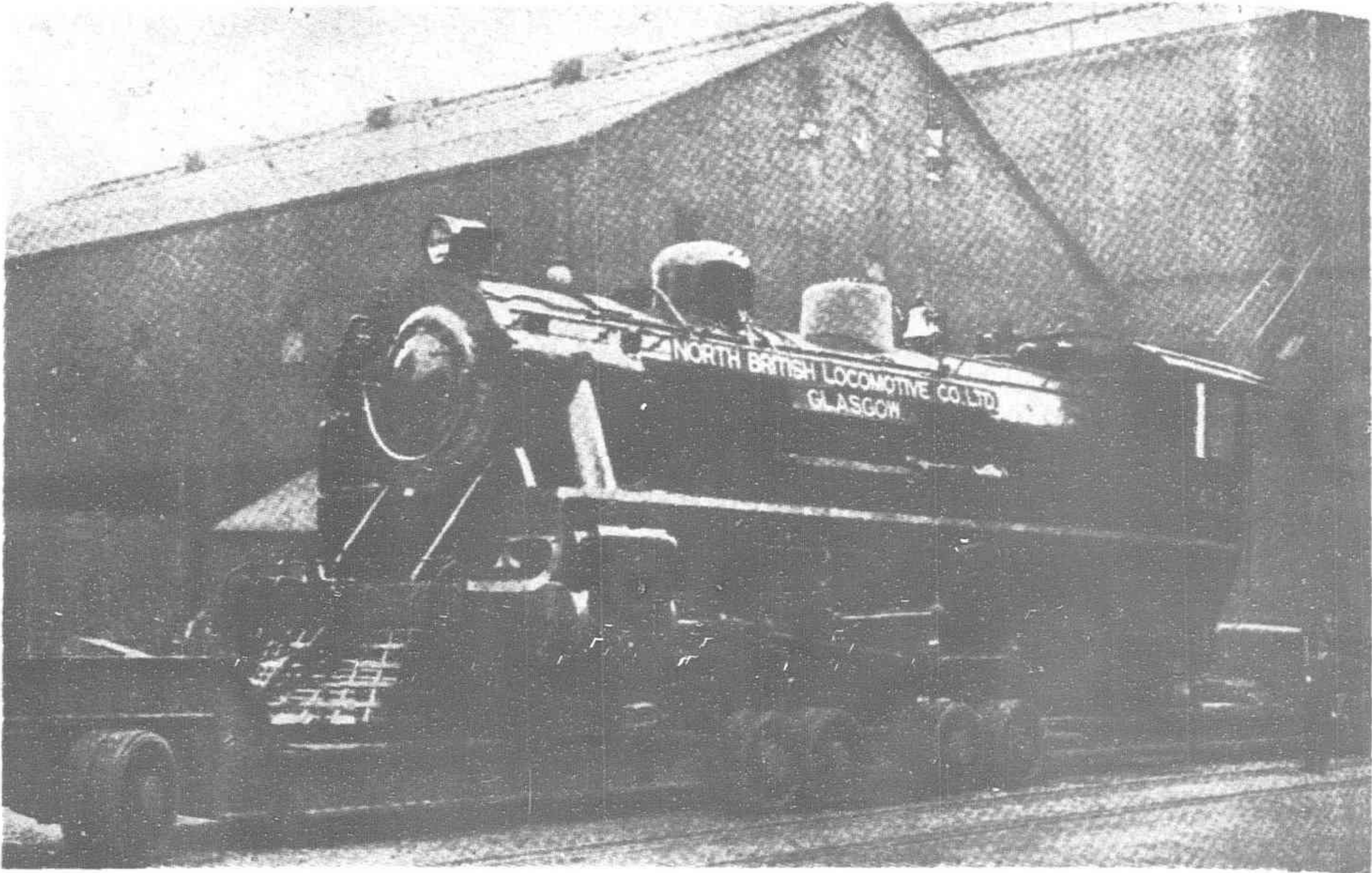
The handling of such lifts at the port of disembarkation often presents quite a problem, but the *Beldis* is equipped with suitable heavy derricks and gear to enable the work to be expeditiously effected at ports where no high capacity dockside cranes are available.

The high loading gauge of the Chinese railways necessitated some care in the transport of the engines from Hydepark Works to the Stobcross Quay, as the loads had first to pass beneath a low overhead railway bridge, which left no alternative to the locomotives being kept as low as possible on the trollies when leaving the works.

Thereafter the route crossed a short bridge with an exceedingly pronounced hog back, which carries the road over the Monkland Canal, the negotiation of which rendered it necessary for each engine to be lifted on the trollies by hydraulic jacks to the extent of six inches. Notwithstanding these adjustments, however, the entire distance of three and a half miles from the Hydepark Works to the docks was covered in less than two hours.



Loading one of the locomotives on board the ms. "Beldis" at Glasgow



One of the locomotives being taken by road to the docks from the works

We reproduce a photograph of these engines, and also give illustrations showing the locomotives on their way to the docks and being loaded on board the m.v. *Beldis* by the Clyde Trust's 175 tons capacity crane.

The leading particulars of the engines are as follows. The accessories include:—

"Hancock" Inspirators, check valves and water column, "Franklin" fire-door, American multiple throttle, Westinghouse ET.6 brake equipment, with 8½-in. cross-compound air compressor, Westinghouse steam-heating equipment, A.R.A.-type "D" couplers, "Bradford" rocker-type draft gear, and "Alco" power reversing gear.

Four of the engines are fitted with Stone's electric lighting and four with Pyle-National lighting equipment.

Cylinders, diameter	20-ins.
Cylinders, stroke	28-ins.
Wheels, front bogie, diameter	3-ft. 0-in.
Wheels, coupled, diameter	5-ft. 9-ins.
Wheels, hind truck, diameter	3-ft. 6-ins.
Wheelbase, rigid	12-ft. 0-in.
Wheelbase, total	32-ft. 1-in.
Working pressure	200 lbs. per sq. in.
Boiler heating surface:—	
Tubes, small	1,176 sq. ft.
„ large	546 „
„ arch	23 „
Firebox	202 „
Total	1,947 sq. ft.
Superheater	443 „
Total	2,390 sq. ft.
Firegrate area	43.5 sq. ft.
Tractive force at 75 per cent	24,350 lbs.
Tractive force at 85 per cent	27,600 lbs.
Weight in working order	90 tons, 10 cwt.

(Continued on page 235)

*Eastern Engineering and Commerce

New Dredger for Bar of the Yangtze*

Craft One of Largest in World of its Kind being Built for the Whangpoo Conservancy Board by Messrs. F. Schichau of Elbing, Germany

Brief History of Dredging Scheme

THE Bar of the Yangtze (generally known as the "Fairy Flats," but actually including other areas, has always been an impediment to ships approaching Shanghai, but in recent years the increased draft of ships and the improvement of depths in the Whangpoo by the Whangpoo Conservancy Board, have made that Bar the most serious obstacle of all. In 1876, Mr. de Rijke, who afterwards became the first Engineer-in-Chief to the Whangpoo Conservancy Board, discussed it. In 1911 the second Engineer-in-Chief, Mr. Von Heidenstam, M.INST.C.E., again called attention to it and under his suggestion a survey of the Yangtze Estuary was made, in conjunction with the Maritime Customs. In 1917 this survey was reported on and on Mr. Von Heidenstam's recommendation and with the cordial approval of the Whangpoo Conservancy Consultative Board, the Whangpoo Conservancy Board inaugurated in 1919 a Shanghai Harbor Investigation. This culminated in 1921 in the convening of an International Committee of Consulting Engineers. Included in the matter prepared between 1919-1921 and submitted to this committee was a project drafted by Dr. Herbert Chatley, M.INST.C.E. (Engineer-in-Chief since 1928), for the dredging of the bar by the drag suction method invented by Otto Fruhling in 1903. The International Committee reported in 1921 endorsing this proposal and the matter was before the Government until 1930, when with the support of Mr. Soong Tse-liang, the Administrative Yuan recorded the Board as charged with the work.

Description of the Bar

The Bar of the Yangtze is over two miles wide and the length in which it affects deep-draft ships is about twenty miles.

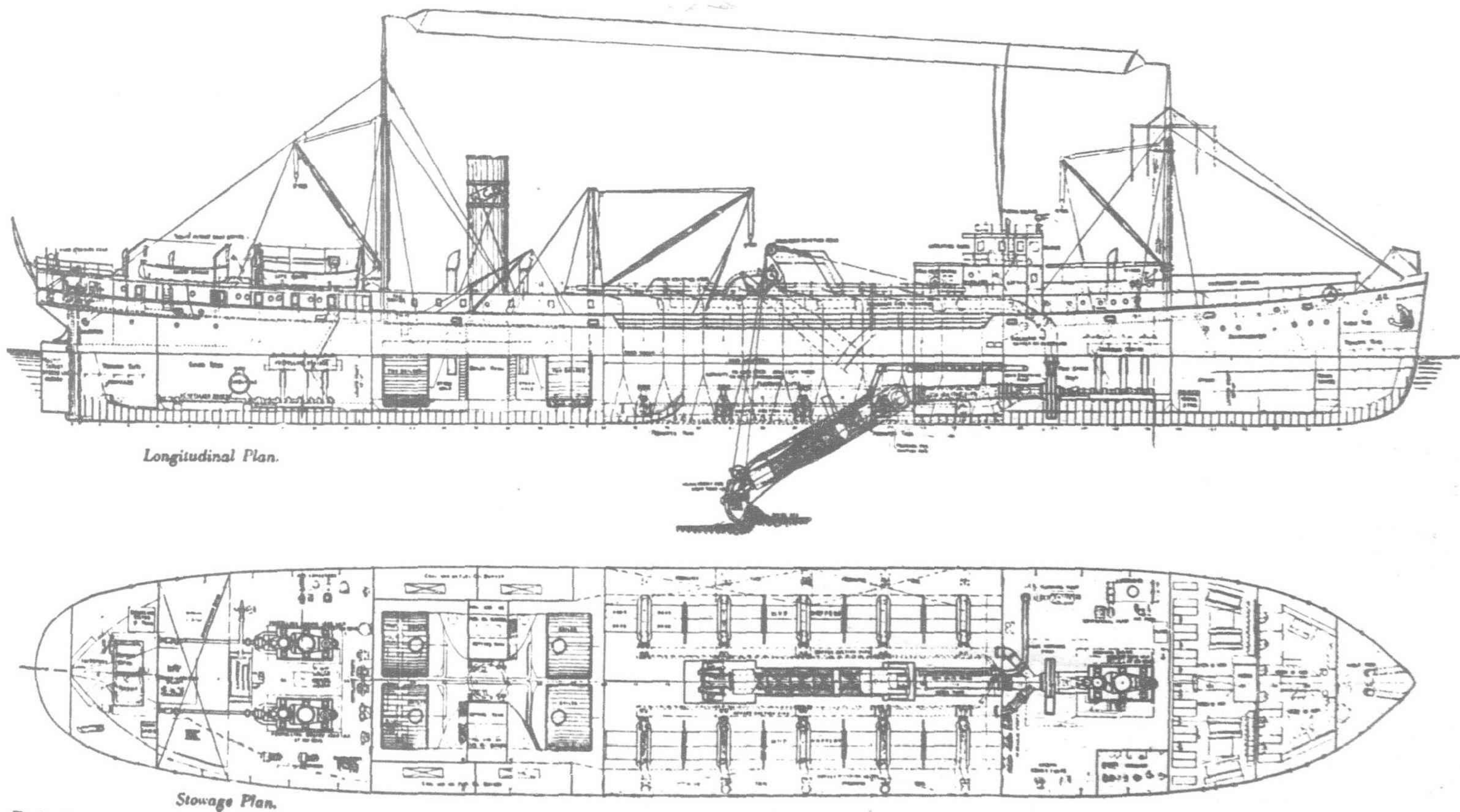
To make a navigable trench in the Bar, 1,000-ft. wide and with a bottom level 9-ft. below the crest of the Bar involves the removal of over 20,000,000 cubic yards of mud. In order to achieve this in a reasonable time and keep ahead of the re-silting which will occur, dredgers of the largest possible capacity are required. The final technical conclusion came to was that an annual output of 10,000,000 cubic yards of mud should be aimed at. For this at least two dredgers would be necessary and the drag type which is not anchored but dredges a long shallow cut while moving was decided to be the only one which offered reasonable hope of success.

Invitation for Tenders

In January, 1931, a world-wide invitation to submit designs and tenders for the first dredger was sent out by the Board. In September, 1931, sixteen firms offered designs at prices varying from £96,000 to £153,000 for types using saturated steam. Many of the designs were unsatisfactory and only a few firms offered the required guarantees. Directly after the tenders were received the British Government abandoned the gold standard thereby throwing the comparison of prices into confusion. Furthermore, the Manchurian and Shanghai incidents upset the economic conditions in China and it was decided in December, 1932, that new tenders should be called for. The sixteen firms who tendered in 1931 were invited to submit fresh offers in accordance with a revised specification and detailed contract.

Ten firms tendered in July, 1933, and after careful scrutiny it was decided to place the contract with Messrs. F. Schichau, of Elbing, Germany, for the sum of £151,800, English currency. This

*The Dock and Harbor Authority



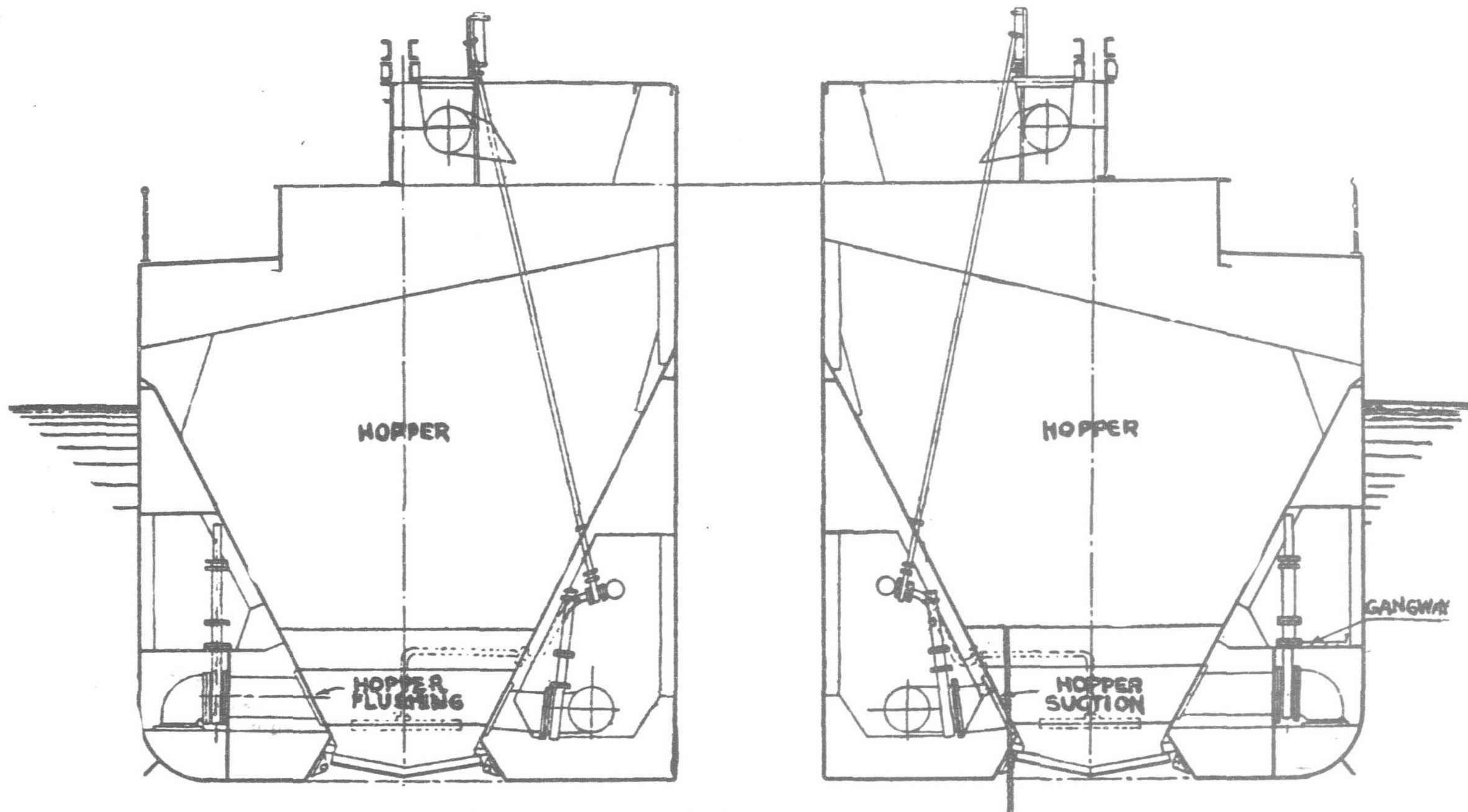
Twin-Screw Drag Suction Hopper Dredger with Central Well. Dimensions 360-ft. by 60-ft. 6-in. being constructed for the Whangpoo Conservancy Board by Messrs. F. Schichau of Elbing, Germany, for Work of Dredging a Channel through "Fairy Flats" forming the Bar at the Mouth of the Yangtze River

firm had been the most favorably regarded in the 1931 proposals and voluntarily offered to renew the guarantee of 90 per cent output against penalty of total rejection. Owing to the depreciation of sterling this price represents an appreciable saving against the 1931 offer, which can be set off against the loss of time. The contract prescribes severe penalties for shortage of output, deficiency of speed, excessive fuel consumption and delay in construction, as well as giving the Board an option of total rejection if the output is less than 22,500 cubic yards of mud per day (dug and transported

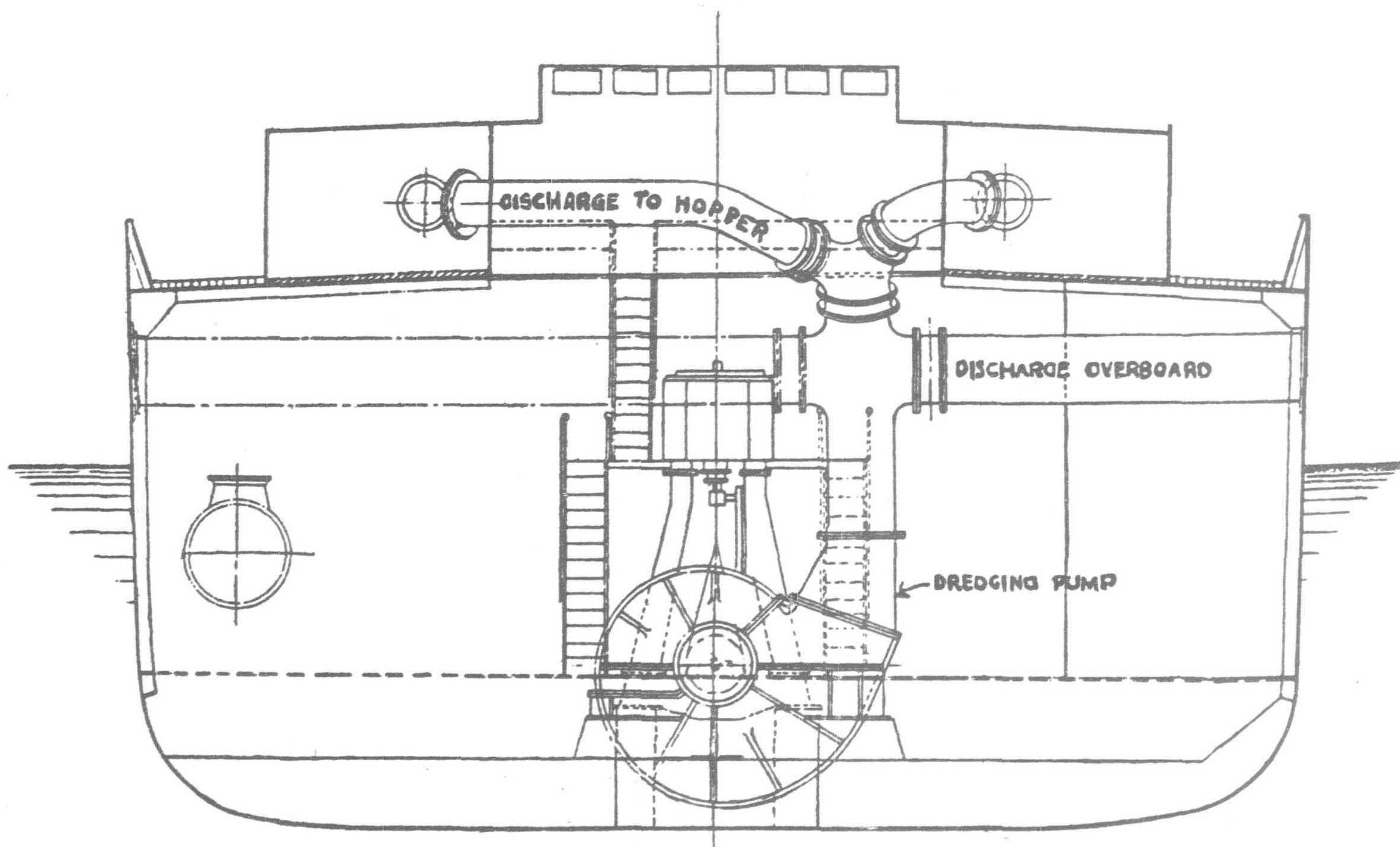
two miles). There is also a clause penalising the firm up to £15,000 in the event of improper tending of commissions, presents, etc., to any director or employee of the Board.

Description of the Dredger

The dredger is to be 360-ft. long by 60-ft. wide, and when loaded with some 2,500 cubic yards of solid mud (plus picked-up water) will draw 18-ft. The propelling machinery has about

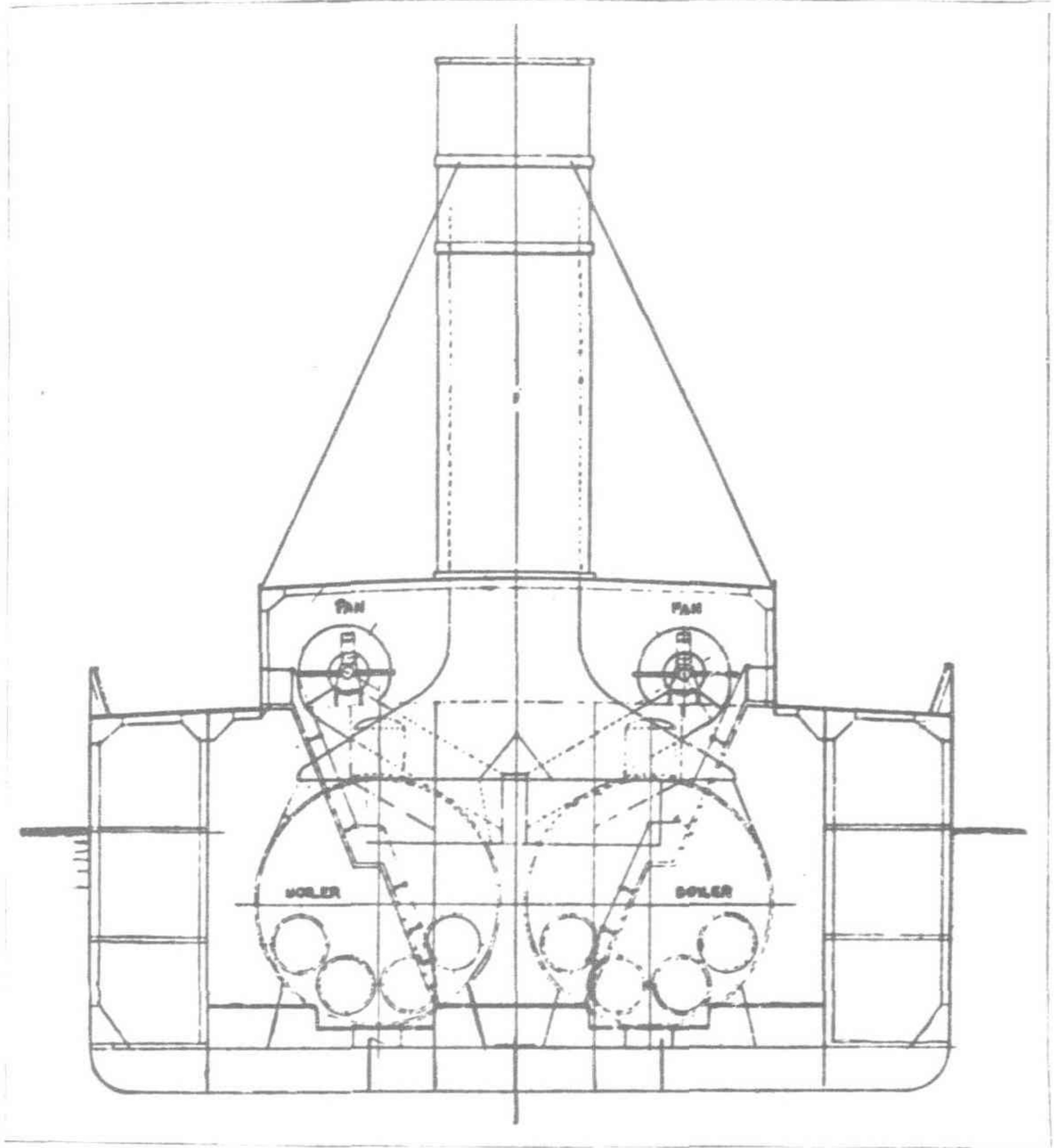


Showing Section through the Hoppers



Section on Frame

2,500 h.p. and the pumps about 2,500 h.p., totalling about 5,000 h.p. The furnaces burn coal or oil. When dredging the vessel will travel at a speed of about two miles per hour over the bottom with the shovel-shaped end of the suction pipe hooking 2 or 3-ft. into the mud. The pipe can be lowered to cut to 45-ft. below water level. The pump will lift a thick mixture of mud and water up the pipe into the hoppers. When the dredger shall have been fully loaded (after about 20 minutes or so) the pipe will be lifted and the vessel will cruise two miles to a suitable place and will



Section through Boiler Room

drop the mud or pump it overboard. She will then return and re-commence dredging.

This dredger will be one of the largest in the world, both in respect to actual size and output. The general arrangements have been prescribed in a highly detailed specification prepared by the Engineer-in-Chief, Dr. H. Chatley, M.INST.C.E., assisted by the late Mr. J. G. Irvine, M.E., Mr. P. N. Fawcett, M.INST.C.E., and Mr. W. Smith, M.INST.N.A. The actual design was made by Mr. Kolkmann, technical expert to Messrs. Schichau.

Circuit-Breakers for Outdoor Service

(Continued from page 219)

Owing to the very ample size of the switch-hood, cable-jointing is very easy, and does not require a high degree of skill.

After the connections have been made, the switch-hood is filled with compound and the top cover is bolted into position. The joint between the switch-hood and the cover is weatherproof, and the cover is provided with a breather to prevent condensation in the expansion-space above the compound.

Standard transformer or switch oil is quite suitable for use in the tanks of these circuit-breakers, but the compound to be used in the switch-hoods varies in grade according to the climatic conditions under which they have to work. Advice on the most suitable grade for each particular installation will always be given. For temperatures below -10°C., special low-freeze compound should be used, such as will not become brittle until about -25°C. is reached.

Characteristics

Operating-voltage up to	15,000-volts
Test-pressure for one minute	36,000-volts
Maximum current-rating	200 amperes
Tank-capacity	18 gallons (82 litres)
Weight, ready for service (excluding supports and framework)	969 lb. (440 kg.)

Eight British-Built Locomotives and Tenders are Shipped to China

(Continued from page 232)

Tender :—

Wheels, diameter	3-ft. 0-in.
Wheelbase	17-ft. 10-ins.
Tank capacity	9.84 tons
Weight, full	57 tons, 8 cwts.

ENGINE AND TENDER

Wheelbase, total	60-ft. 4-ins.
Weight, total	147 tons, 18 cwts.

The Kuznetsk Metallurgical Works

(Continued from page 231)

That is really remarkable. In a country almost entirely devoid of any industrial experience, built by men even the most experienced of whom have had no previous experience of that sort of work on that sort of scale, it has been found possible to produce more than even the notoriously high Soviet planned requirements.

Kuznetsk was built not in accordance with Western patterns. Instead of first arranging for reasonable living conditions for the workers, making roads and then beginning the plant construction, they began at the other end. Lack of time was really the root reason. But Kuznetsk was built, and, considering all things, well built, and the lessons learnt by experience in building it should render the further steps in the industrialization of Siberia far less painful and far easier. Kuznetsk has been very lucky in that from the beginning it has been directed by the same Director and Chief Engineer. The experience that Mr. Frankfurt and Mr. Bardin, have had of building a great works in Siberia should be invaluable in further work of this kind. Already the Harvester and Mine-Equipment works in Novo-Sibirsk are profiting by the Kuznetsk experience. Kuznetsk has set the ball rolling.

The governing body of Kuznetsk plan a great locomotive works in the steel mill's vicinity and another steel mill, twice the size of the present one, near the River Tom. The exploring work in the Altai Mountains has resulted in the discovery of good ore in Telbes and Tamir-Tai. It is believed that in the very near future these mines should provide about seventy per cent of the ore necessary. In this way a new, less unwieldly combine should arise creating a new, industrialized Siberia.

Hydro-Electric Power in Kwangtung

(Continued from page 218)

would cost many millions of dollars—but it would keep the factories of Europe and America busy for many years. Unfortunately for the realization of such dreams we must make money earn money.

There are, however, possibilities of utilizing some of the enormous energy of the water of the tributaries of the Yangtze. That problem is, technically, quite as interesting to-day as was that at Niagara fifty years ago, when a Commission of experienced engineers was asked to plan the schemes. The result of their work in practice, has been a great success.

What is needed in China to-day is an International Commission of the greatest experts on water power in the world to prepare data, and to give advice, as to the most expedient manner of transforming some of the terrific energy now running to waste in the Yangtze Valley and other parts of the country into electric power.

Where possible the scheme must be interlocked with plans to mitigate the disasters caused by occasional floods. Not long ago we saw any amount of evidence of the terrible damage done, only three years ago when an enormous area of country around Hankow was inundated.

At the present time our main hopes are centered on the Yung River scheme, which has the enthusiastic support of all of the more educated Chinese in the districts that will be affected by it.

Last week the Mayor of Canton and some of his colleagues visited Hongkong and inspected some of the engineering works. We may hope that the Cantonese officials will make such visits frequently. For they can see in Hongkong the many advantages of utilizing the forces of nature for the use and convenience of mankind.

Boiler Control in a Japanese Power Plant*

AT the Maeda Power Station in Shimonoseki, Japan, an extensive boiler-control plant, furnished by Siemens & Halske, Berlin, has been in satisfactory operation since March, 1932. This plant was installed on the occasion of an extension to the power station, when a 12,500 kw steam turbine and three Babcock & Wilcox boilers with travelling-grate stokers and zoned air control were installed. Each of these boilers has a heating surface of 752.5 sq. m. (8,000 sq. ft.) and supplies 34 tons of steam per hour at 440 deg. C. (825 deg. F.) and 38.7 atmos. (550 lb. per sq. in.) working pressure. The boiler output can be raised to approx. 39 tons for four hours. It was for these three boilers that the control plant was procured.

The local conditions at the power station made it necessary to combine into one unit the three instrument panels for the different boilers and the main control and relay panel, Fig. 1. This requirement did not present any difficulties, since both control and tele-indication are effected electrically and require for their transmission only thin cables, which can easily be laid to suit local conditions. Each boiler panel contains a pressure indicator and a steam meter equipped with large dials, which can be read from a great distance. The steam meters are fitted with a mechanical counter, which in a simple manner enables the steam production to be ascertained at any time. In addition, a recording instrument has been provided. The other data necessary for judging the performance of the boiler are indicated on two sets of four edgewise instruments and recorded by two multi-color recorders. Finally, each panel, in addition to the requisite switches and regulating levers, contains two chopper-bar instruments which enable the CO_2 and $\text{CO} + \text{H}_2$ content of the flue gases to be taken into account in the automatic boiler regulation.

As usual, the regulation extends to the supply of fuel and of combustion air, and to the pressure of the undergrate blast. The fuel feed is regulated by changing the speed of the motors driving the travelling grate, the automatic regulation influencing only the last two of the

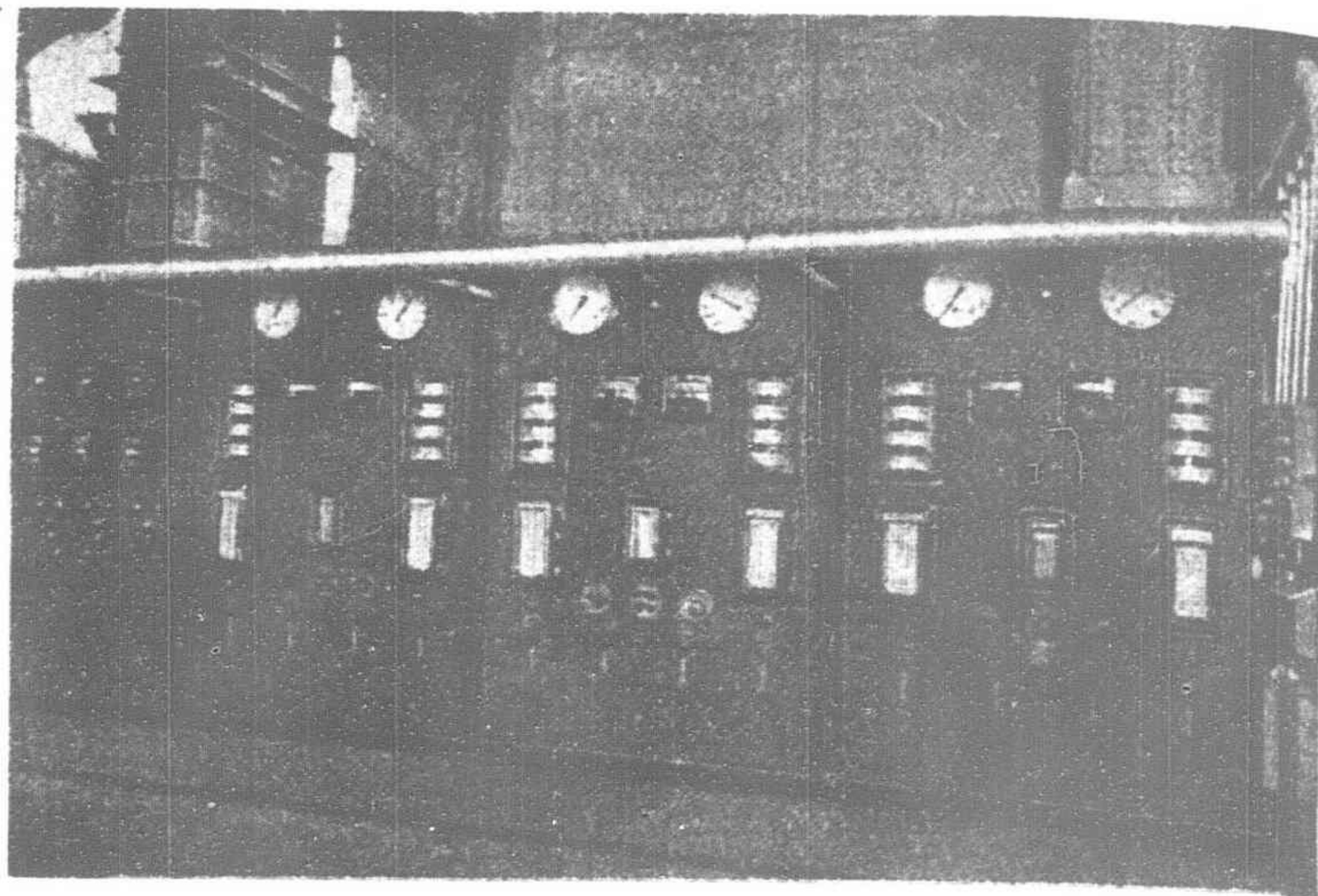


Fig. 1.—Boiler-Control Panel at Maeda Power Station

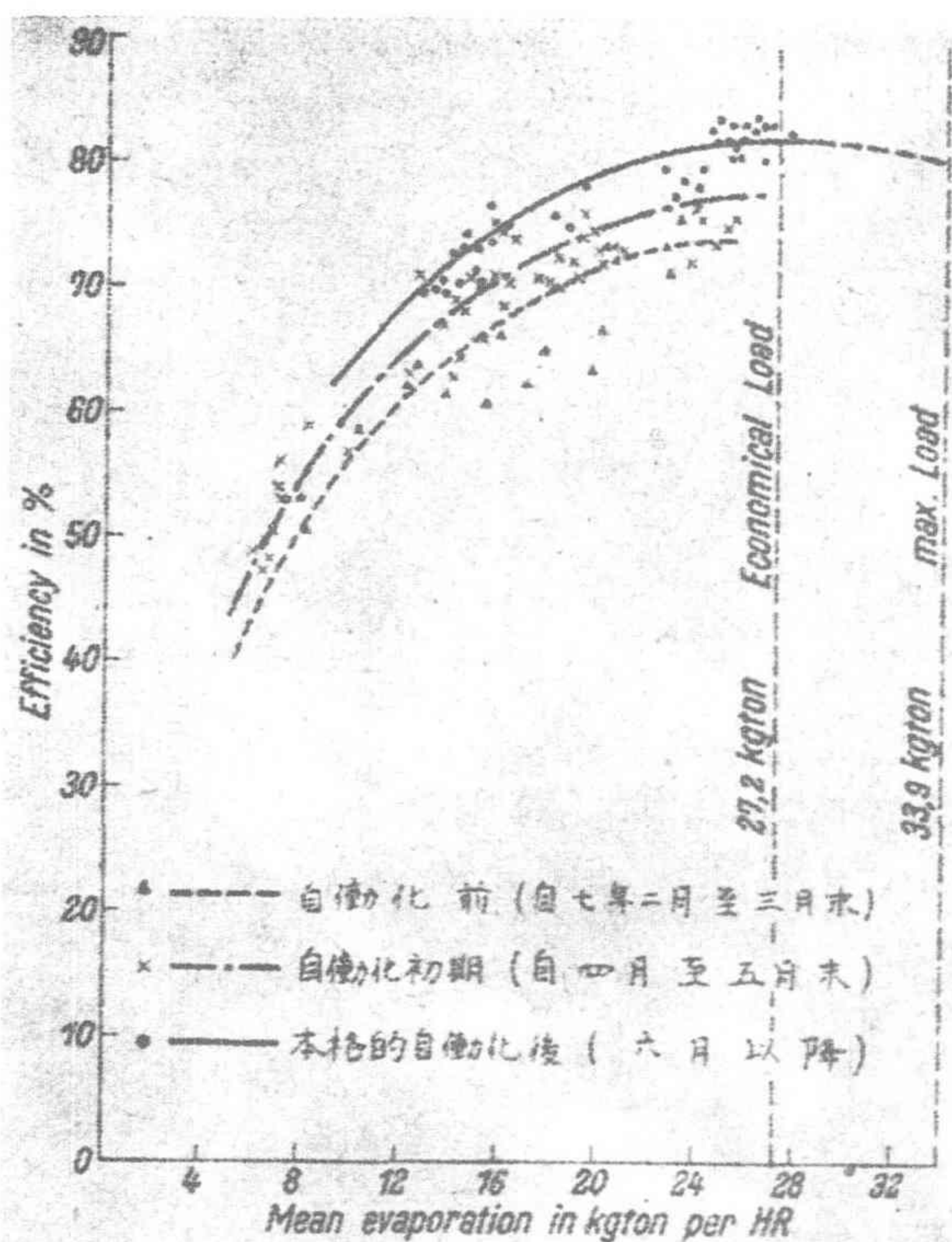


Fig. 2.—Efficiency in Terms of Mean Evaporation
 ----- Before Starting Automatic Control (February and March, 1932)
 - · - - - After First Introduction of Automatic Control (April and May, 1932)
 ——— Automatic Control in Regular Operation (after June, 1932)
 (Facsimile of an Original Japanese Test Sheet)

total of eight regulation stages. The combustion-air supply is regulated in two mutually complementing ways, i.e. by varying the speed of the two induced-draught fans and by adjusting two throttle flaps in the flue. The regulation of the undergrate blast is effected in a similar manner by motor-speed variation and adjustment of throttling flaps.

Figs. 2 and 3 illustrate the improvement effected by applying the automatic boiler control. The records of Fig. 3 have been taken prior to, and after, starting the control.

The turbine panel, Fig. 4, contains all the instruments which show the working of the turbine. The steam pressure ahead of the turbine is indicated by a large-dialled instrument located above the upper edge of the panel proper. This instrument is equipped with a ring tube, by which the readings are transmitted to a six-color recorder in the center of the panel. This latter instrument records also the temperature of the steam and the amount consumed by the turbine. The two large-dialled instruments indicate the steam consumption and the amount of the condensate. In addition, there are two

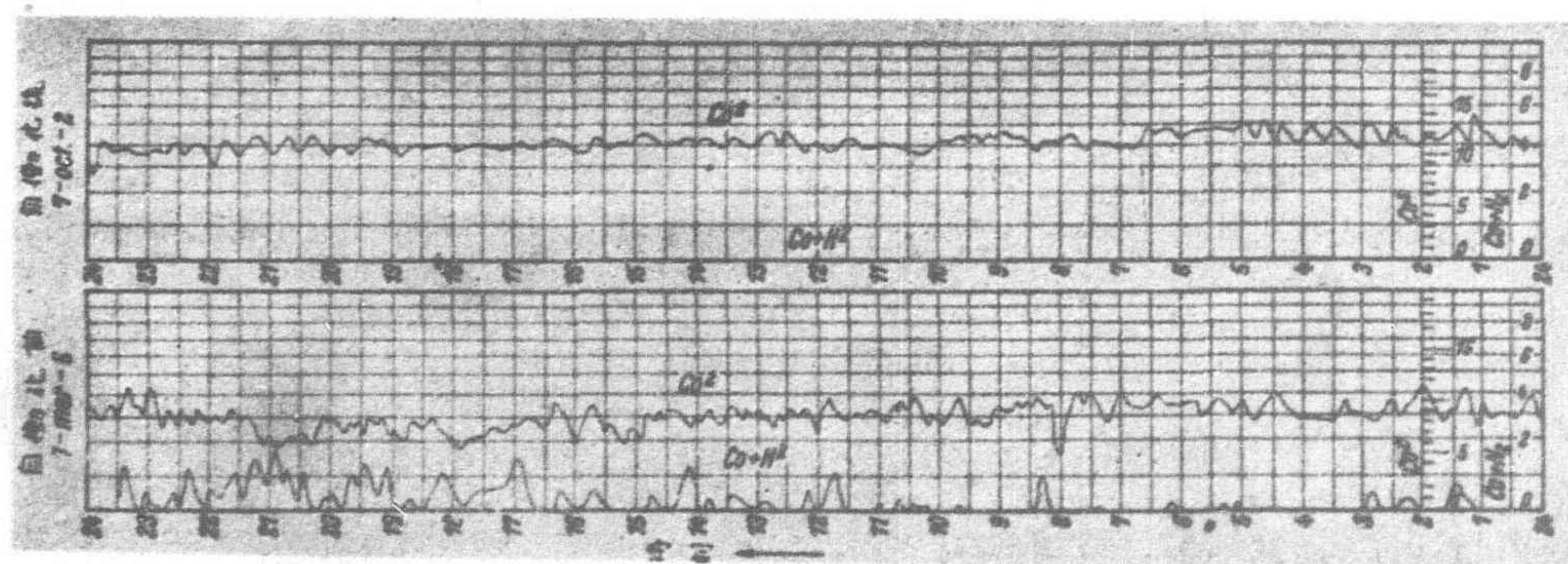


Fig. 3.—Records of CO_2 and $\text{CO} + \text{H}_2$ Content. Below: Before starting the automatic control. Above: Automatic control in operation

chopper-bar instruments, one recording the amount of vacuum in the condensate chamber, the other the amount of condensate. An addition of a later date is a megawatt meter, which indicates the output of the generator.

*Engineering Progress.

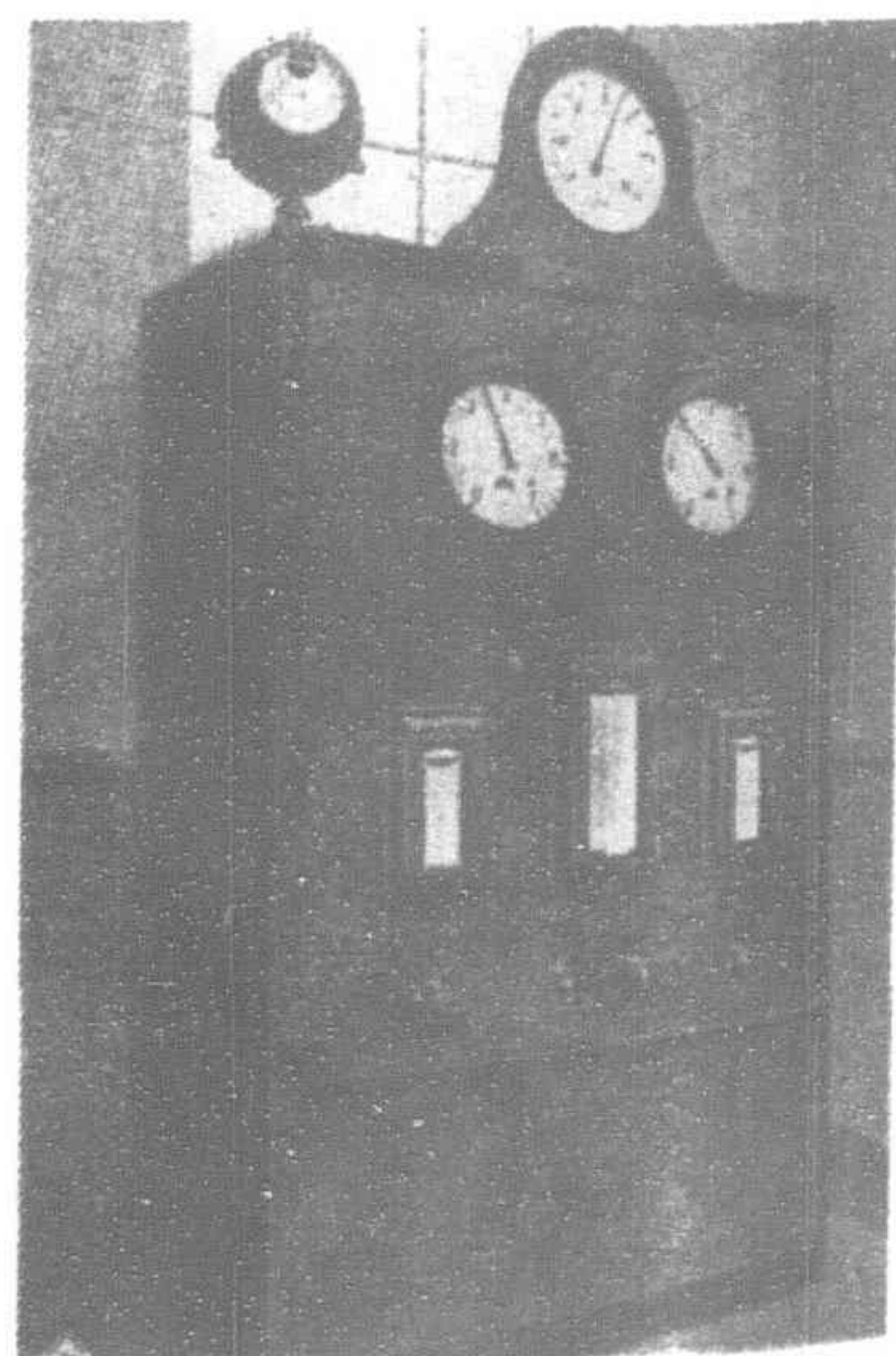


Fig. 4.—Turbine Panel at Maeda Power Station

The New Cargo Motor-Ship "Shinshu Maru"

First Vulcan Geared Motor-Ship in Japan is Equipped
with Mitsubihshi Four-Cycle, Trunk Piston Diesel Engines

THIS vessel has been constructed and engined by the Kobe Shipyard and Engine Works of the Mitsubishi Jukogyo Kabushiki Kaisha (formerly known as Mitsubishi Zosen Kabushiki Kaisha), to the order of the Azuma Steamship Company, Ltd., Kobe, for their regular service between ports in Japan proper, Formosa, South China and Korea.

The ship was laid down on April 19, 1933, launched on November 15 and completed on February 10, 1934. A notable feature of the vessel is the adoption of Vulcan gear and couplings, manufactured by the builders themselves under a license from Messrs. Deutsche Schiff und Maschinenbau A.G. in Germany.

It may be termed an epoch making event in Japanese Ship-building, and the action of the Azuma Steamship Company in adopting the Vulcan gear for their new ship is keenly appreciated by those interested in the development of marine engineering in Japan.

The ship has been arranged for facilitating the loading and discharging of molasses, fruit and general merchandise, including the provision for taking molasses on board from tanks on land, by means of pipes and hoses and cargo handling appliances of high efficiency.

On her maiden and subsequent voyages to Formosa, splendid results have been obtained, which prove that the ship is not only economical but also easy to manœuvre.

The leading particulars are as follows :—

Length over-all		373-ft. 8-in.
Length between perpendiculars		360-ft. 0-in.
Breadth moulded		50-ft. 0-in.
Depth		29-ft. 0-in.
Draft fully loaded (mean)		23-ft. 8.8-in.
Speed on trial		16.302 knots
Gross tonnage		4,180 tons
Deadweight capacity		6,330 tons
Cargo capacity (excluding cold storage)		271,970 cub. ft.

Classification To Japanese Government Rules and Regulations for ocean going vessels, first grade full scantling vessel; Imperial Japanese Marine Corporation N.S. British Corporation B.S.

General Arrangement

The vessel is a pure cargo boat, having a complete double bottom and two longitudinal continuous decks, viz., the upper and second decks.

Above the upper deck there are the poop, bridge and forecastle erections; the partial decks amidships being designated the bridge deck, boat deck and flying bridge deck respectively.

The watertight subdivision of the hull is effected by six transverse bulkheads and there are thus seven main compartments, viz., four cargo holds, fore and after peak tanks and engine room, which is located amidships.

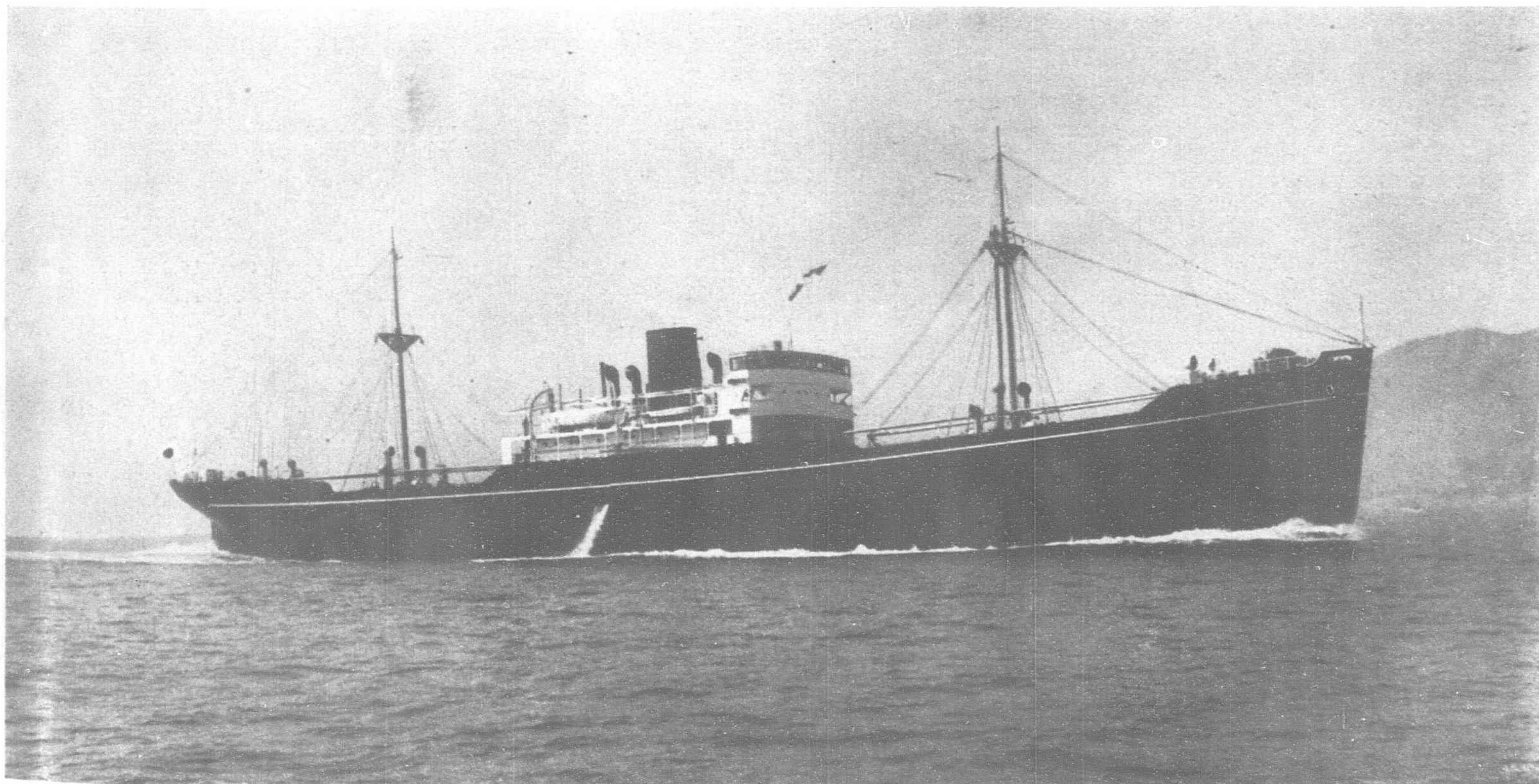
There are a large funnel of elliptical shape on the top of the engine room casing and the two masts which are slightly raked.

Further cargo spaces, which may be used for fruit cargo holds, are provided at the forward part of the bridge and the after part of the forecastle deck.

On the bridge deck is situated the deck officers', engineers' and purser's cabins, officers' dining-room, pantry, crew space, mess-room and store, etc., while a captain's cabin, chart room and wireless telegraph office are provided on the boat deck.

Form of Hull and Propeller

Most careful attention was paid to the design of the hull of the ship, and her form and the propeller were determined after exhaustive trials at the Experimental Tank of the Mitsubishi Nagasaki Works.



Motor-ship "Shinshu Maru" on trial run

Cargo Handling Appliances

Two sets of cargo handling equipment are installed for each of the Nos. 1, 2, 3 and 4 hatchways, provided with booms of Mannesmann steel tubes, each boom having a lifting capacity of three tons. In addition, a steel heavy derrick of 15 tons capacity is also installed for No. 2 hatchway. Electric winches, the joint manufacture of the builders and their sister concern, the Mitsubishi Electric Engineering Company, Ltd., number eight in all. Each is of a capacity of three tons, and has the speciality of being simple to handle and quick and exact in operation, and does not require much power. An electric pump for dealing with molasses is also provided in the engine room.

Rudder and Steering Gear, etc.

To minimize the resistance of the hull, a stream-lined double-plate balanced rudder has been adopted. An electrically-driven steering engine, of the Ward-Leonard control system, manufactured by the Mitsubishi Electrical Engineering Company, is installed in the steering engine room on the poop. Steering wheels are fitted not only on the flying bridge but also on the poop, and the engine can be connected with either wheel instantaneously as required. A hand steering gear is also provided as spare.

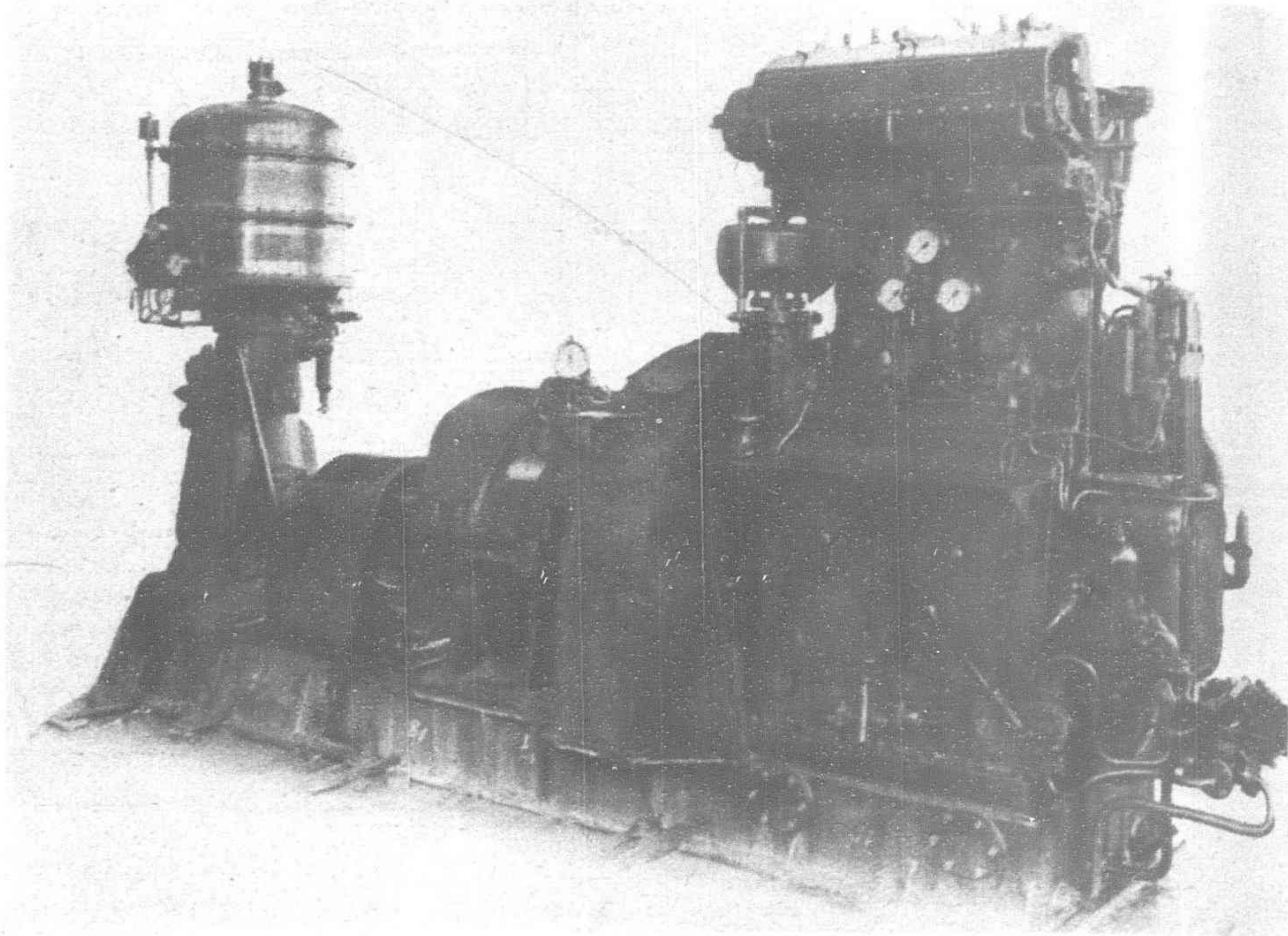
Wireless Telegraph Installation.—This installation consists of one k.w. apparatus of the valve system and one spare, of $\frac{1}{4}$ kw. of the spark system, and is located near the chart room on the boat deck.

Molasses Tank and Cold Storage Room.—To store molasses, a large tank, divided into four compartments, has been provided in the No. 2 hold, of a capacity of 12,100 cubic feet, so arranged as to be heated by the discharge water of jacket cooling of the main engine. The discharging of molasses is carried out, through a pipe line, by the molasses pump in the engine room. A cold storage space of a capacity of about 4,480 cubic feet is arranged forward on the No. 3 'tween deck.

Main Engine

The propelling machinery comprises two sets of Mitsubishi single-acting, four-stroke-cycle, airless injection, reversible Diesel engines, type SHI. 8. Each engine develops a normal output of 1,350 b.h.p. at 420 r.p.m., and this speed is reduced to 90 r.p.m. at the propeller shaft.

The engines, which are illustrated in an accompanying photograph, embody a most elaborate design combined with the highest standard of workmanship, based on long years of experience in Diesel construction possessed by the builders, the Mitsubishi



The 50 kw. Dynamo of the Motor-ship "Shinshu Maru"

Kobe Works. The engines are of robust construction, and easy to operate, and have the lowest fuel consumption.

Vickers' solid injection system is adopted for the fuel injection, which has a minimum number of fuel oil pumps and enables easy adjustment of the fuel injection pressure, also eliminating troubles in the fuelling system as well as holding a high thermal efficiency in a large scope of the variation of revolutions and outputs.

A special design has been applied to this engine for the shape of combustion chambers and the direction of injection, so that the result of combustion has been especially good and the exhaust gas utterly smokeless at any load.

The two sets of engines are coupled to one propeller shaft through the medium of Vulcan gear and couplings, also manufactured by the builders.

Vulcan Gear Installation

The installation includes hydraulic couplings, reduction gear wheels and primary thrust bearing on the Vulcan system, particulars of which are as follows:—

Normal output 2,570 h.p. (at the after end of the gear wheel shaft).

Normal speed:

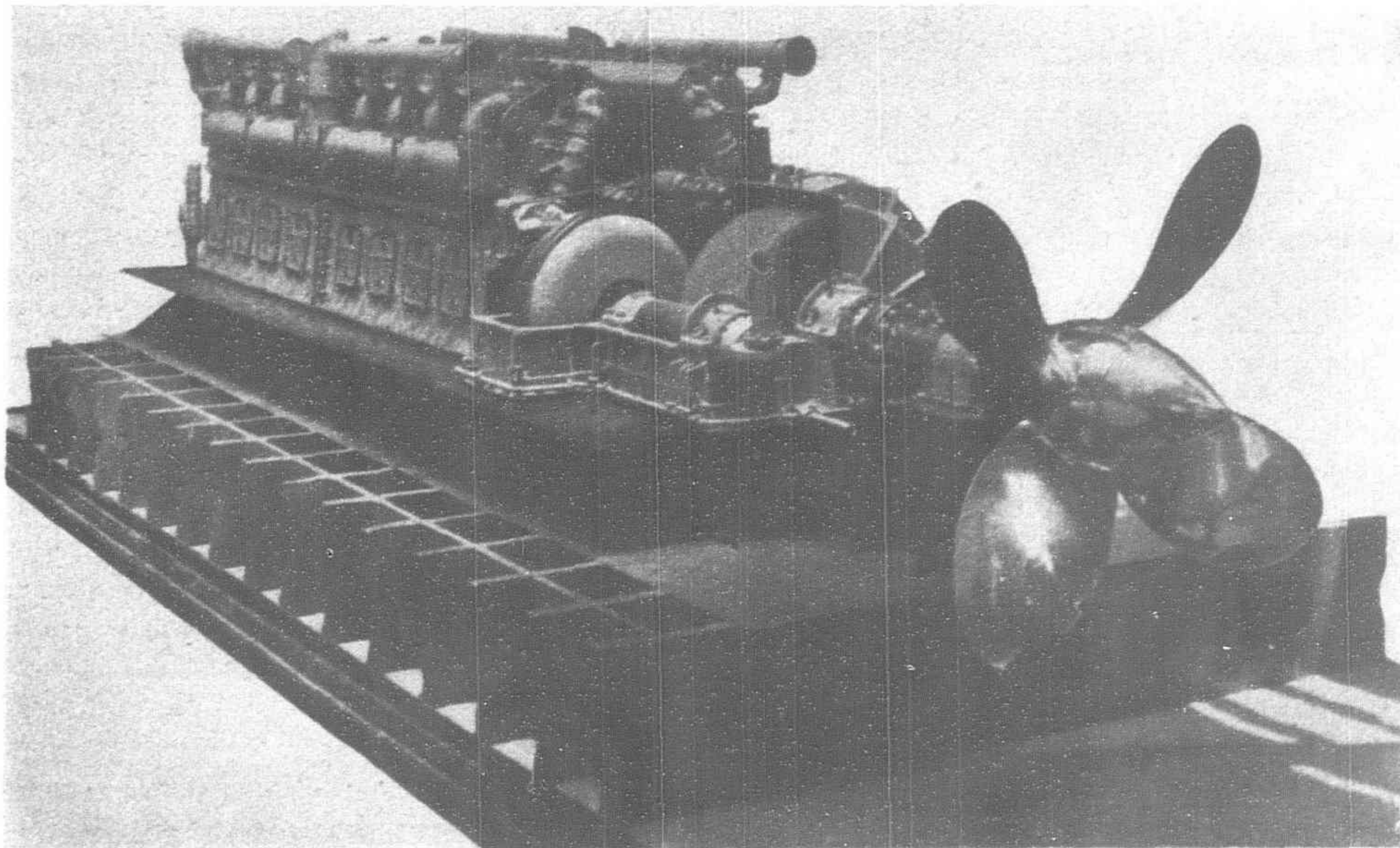
Main engine 420 r.p.m.

Propeller shaft 90 „

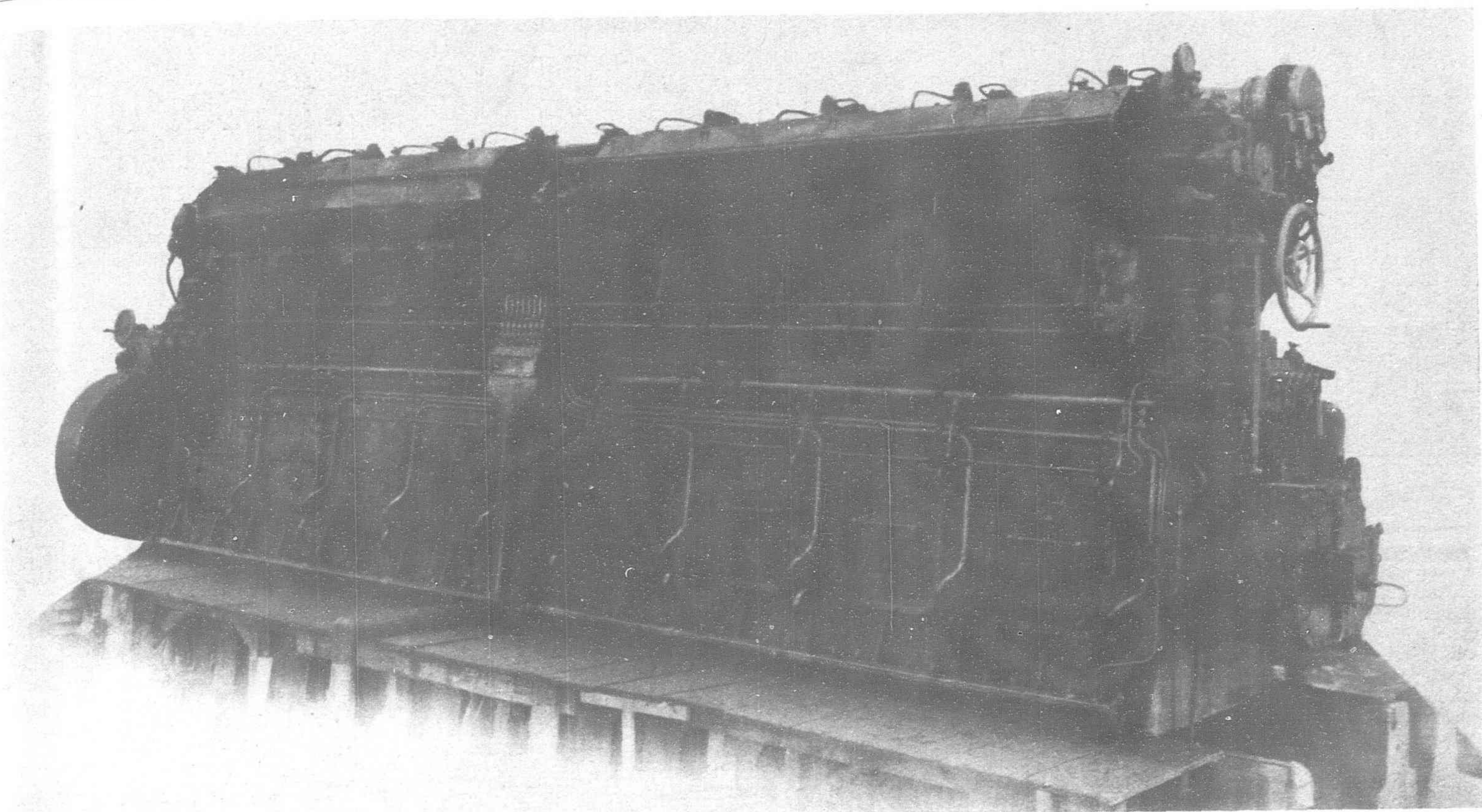
The working medium is lubricating oil. The gear is non-reversible, and the reversing manœuvres are carried out with the main engine, which is connected or disconnected from the propeller shafting by filling or draining the oil in the couplings.

Trial Result.—The trials were carried out at one-fifth loaded condition, and the results were eminently satisfactory. Extracts from the records are as follows:

- (a) A maximum speed of 16.302 knots was recorded with two engines at 100 r.p.m. on the propeller shaft, and 12.246 knots with one engine at 72 r.p.m.
- (b) A minimum speed of 3.69 knots was recorded with one engine at 25 r.p.m. on the propeller shaft.
- (c) Entirely uniform torque in the propeller shaft was recorded by the torsion recording apparatus.
- (d) Easy manœuvring.
- (e) Reliability of running.



Model of the Propelling Machinery of the Motor-ship "Shinshu Maru"



Main Engine of the Motor-ship "Shinshu Maru"

Auxiliary Machinery

The following auxiliaries are provided :—

3 sets of Mitsubishi airless injection four-stroke Diesel engines, type MRZ2, each developing 75 b.h.p., direct coupled to dynamo of a normal output of 50 kw. at 225-volts, the latter supplied by the Mitsubishi Electrical Engineering Co. One of these dynamos is connected to an air compressor of Mitsubishi-Weir type by a clutch for starting operations. For emergency use, one oil engine driven compressor is also installed.

- 2 sets Jacket cooling and lubricating oil pumps, each having a capacity of 135 cub. meters per hour (one as spare).
- 2 sets Piston cooling water pumps—70 cub. m./hr. (one as spare)
- 1 set Vulcan gear oil pump—50 cub. m./hr.
- 1 set Molasses pump—70 tons per hour.
- 1 set Fuel oil purifier—1,000 L. per hour.
- 1 set Lubricating oil purifier—500 L. per hour.
- 2 sets Lubricating oil coolers.
- 1 set General service pump—30 cub. m./hr.
- 1 set Fresh water pump—3 cub. m./hr.
- 1 set—Fuel oil transfer pump—15 cub. m./hr.

Chinese Antimony Exports

The absorption of Chinese supplies of antimony regulus, oxide and crude antimony during the second quarter of last year by European and American importers experienced a considerable expansion against the first quarter, the quantities gone to the United States being 1,035 tons and to European ports 1,450 tons, thus making an aggregate of 2,485 tons. The takings by the United States for the first quarter were only 335 tons. The much freer provision made by American importers in the second quarter, however, has not been accompanied by any material revival of activity from domestic consumers for refined metal, the demand for which has been rather lagging throughout, even in spite of the small concessions which were made since the beginning of this month down to 6.75 cents per lb. on the spot. The total shipped of regulus from China to America this year to the end of August amounted to 1,583 tons against only 835 tons for the corresponding period last year. These figures are still a long way below those for the year 1930, the total for which was as much as 5,698 tons. As on this side, consumers there seem anything but keen to buy in excess of their actual needs owing to the obscure industrial outlook, so that importers are up against some difficulty in disposing of their holdings. Chinese regulus here lying in warehouse is held for terms ranging up to £27 a ton covering the duty, but parcels might be obtained at £26 10s. Only very little interest has been shown of late for China crude metal from the chemical trades, and orders could probably be easily placed at £18 10s. c.i.f. for forward shipment, and for white oxide at £26 10s. delivered warehouse.

European imports from China have been largely in the shape of regulus chiefly to London, Hamburg and Rotterdam, while fair quantities are also going to Havre, and consignments being made to Marseilles, Genoa, Liverpool and Scandinavia, including Denmark. Production in China for August was estimated at 750 tons or the same as for the preceding month, this comparing with 1,100 tons for the same month last year. Stocks at Changsha, Hankow and at the mines on August 31 were placed at 3,650 tons, or 1,030 tons less than a year before. The Hunan Government recently withdrew from active participation in the Antimony Trade Association of Hunan which was formed at the close of last year, and comprises all those connected with the industry, including banking interests, and it is reported that this withdrawal has led to the resignation of various firms including one of the principal exporters and leader of an important group within the association. The working of the latter has thus been rather interfered with, and various dealers have been simply confining themselves to the edict of the association for payment of 10 per cent tax *ad valorem* on all antimony shipped from Changsha, while the Hunan Government sustained this tax. Criticism of this heavy tax has been so strong among dealers that the Hunan Government compromised by reducing the tax to 2 per cent, which reduced rate is expected to be adopted shortly. Possibly this reduction will influence prices, while it is understood at the association hold approximately 1,500 tons of the surplus of antimony lying at Changsha.—*Oil and Color Trades Journal*.

Engineering Notes

INDUSTRIAL

NEW RAYON FACTORY.—The Kanegafuchi Spinning Company has purchased land in preparation for rayon production according to the Viscose method. Construction of the factory will start early next year, and the initial productive capacity will be five tons a day. The necessary power supply will be based on its own generation. The company also has decided to manufacture industrial chemicals in a factory to be erected on the same site. Caustic soda, sulphuric acid and other chemicals for rayon manufacturing and printed cloth will be made.

COMBED WOOL FILATURE.—It is learned in Shanghai that a contract has been signed by the Governor of Shansi, with a French firm for the delivery of the complete equipment of a filature for combed wool, to be established at Taiyuanfu. The machinery will be ordered from France and a specialist will be sent out for its installation. The cost is estimated at Fr.2,000,000. The new filature will be the first of its kind in China. The equipment will be supplied by a firm in Mulhouse, which, in a way, introduced the combed wool industry to Japan, having supplied the equipment for the largest filatures existing in that country.

MAGNESIUM PLANTS.—The Japan-Manchoukuo Magnesium Company has called in a quarter of its capitalization of Y.7,000,000. The leading investors are the South Manchuria Railway Company, Rikagaku Industrial Company, Sumitomo interests, Mitsubishi Aircraft Company, and the Furukawa, Ube and Watanabe interests. The company has taken over the Riken Magnesium Company, capitalized at Y.800,000. The Naoetsu factory, with an annual production of 150 tons of magnesium, will be the main factory. The second plant will be erected at Ube City in Yamaguchi Prefecture, and is expected to be completed before October next year. The annual production of the Ube plant will be about 250 tons.

JAPAN'S FLOUR MILLS.—Many flour mills in Japan have been increasing their capacities. The Masuda Mill, in Kobe, is erecting a 500 barrel mill at Shinkoyasu, in Kanagawa Prefecture. The Nisshin Flour Mill has just raised the capacity of its Tsurumi plant by 4,000 barrels. When the Tsurumi plant is complete it will be able to turn out 12,000 barrels a day, and will be one of the largest in the world. The Nankosha, in concert with the Shimoshima Flour Mill Company, has decided to erect a 500 barrel mill between Tokyo and Yokohama, and has already ordered the machinery from Germany. The Ministry of Agriculture and Forestry is also subsidizing farmers to buy small motors to mill their own wheat. More than 2,000 such motors have been purchased, and these will turn out 3,000 barrels a day.

CANTON PUBLIC WORKS.—Plans for the construction of a reservoir capable of supplying 10,000,000 gallons of water daily are announced by the Canton Public Utilities Bureau. The project will cost about \$2,000,000 and will require one year to complete. The reservoir will facilitate the installation of water mains to Honan, across the Pearl River. The foundation-stone of a new \$5,000,000 bridge at the west end of Canton has been laid. The bridge, when completed, will link up the Canton-Hankow and Canton-Samshui railways. It is the second of a series under the three-year reconstruction plan, the first being the Pearl River bridge, which was completed early this year. The Canton-Shaokwan section of the Canton-Hankow Railway has taken over the new section from Shaokwan to Lohchang. The portion at Fungmeishan still requires construction which will cost \$1,300,000 before the train service can begin. Work will be completed in six months' time.

MOTOR MANUFACTURE IN JAPAN.—Tobata Cast Iron Company, in north Kyushu, has decided to manufacture automobile parts. The Japan Automobile Company, Tokyo Gas Denki Company, Kawasaki Car Manufacturing Company and Mitsubishi Shipbuilding and Engineering Company are all producing motor-cars for military purposes, and the work is so heavy that present equipment is inadequate. According to present plans, Tobata will concentrate on the production of motor-car parts at a new factory, where production of 10,000 automobiles of the Datsun type a year is also planned. Production of domestic automobiles in Japan for 1932 numbered 840, while reassembled Fords numbered 7,400, and General Motors, 5,900. When Tobata's new factory is completed, it is believed its manufactures will oust a considerable amount of imports.

SHIPPING

RECORD PRICE FOR SHIP.—The Red Star liner *Lapland* has been sold to Japanese shipbreakers for a sum in the region of £30,000. This ship, of 18,694 tons gross, was built in 1908 for the International Mercantile Marine Corporation, of America, but sailed under the British flag, and for many years was one of the best-known trans-Atlantic liners. She is now lying at Antwerp, where she will be taken over by the buyers. The purchase price is the highest figure ever paid for a merchant ship for scrapping. For the first nine months of the present year 1,416,000 tons gross of shipping has been scrapped, compared with 857,000 tons for the corresponding period of 1932. At the present rate of progress, it is likely that the total figures for 1933 will be in the neighborhood of 2,000,000 tons gross, against just under 1,000,000 tons last year.

RAILWAYS

BRIDGE OVER CHIEN TANG.—Interviewed regarding the proposal for the erection of a railway bridge over the Chientang (River), Mr. Tseng Yang-fu, Provincial Commissioner of Reconstruction for Chekiang, said that construction expenses are estimated at \$5 millions. The Chekiang authorities have already secured the services of three British and American railway engineers, who are now preparing plans.

JAPANESE CABLE RAILWAY.—Approval of a project to construct a cable railway up Mount Mihara on Oshima island, Tokyo Bay, was given on December 21 by the Japanese Ministry of Railways. Mihara is an active volcano and became famous last year as a popular suicide spot. According to plans, the cable-car line will cover about 1,800 meters, or more than a mile, rising from the village of Motomura to the summit. It is expected that work will start on the line this year, and that it will cost about Y.400,000. The company will be called the Mihara Mountain Railway Company.

RAILWAY CONSTRUCTION.—Built entirely with Chinese capital and by Chinese engineers, the Hangchow-Kiangshan Railway has just been extended across the Kiangsi border to Yushan and thus completely spans prosperous Chekiang. The extension will ultimately be connected with the Canton-Hankow line at Pinchang. The line is standard gauge, carries modern coaches, and traverses some of the most fertile and prosperous country in Chekiang Province, with scenic beauty unsurpassed. This railway, a monument to the Department of Construction, marks the most economical bit of railway construction in China. The total length of the line is 360 kilometers and the total cost \$13,000,000, or about \$36,000 per kilometer.

MANCHURIAN RAILWAYS.—According to an official announcement by the South Manchuria Railway Co. seven railway lines are to be laid down in Manchoukuo under contract with the Government of Manchoukuo, at a cost of Y.141,420,000. The seven proposed lines are:—Mutanchiang, Chimussu; Lingyuan, Chengteh (Jehol City); Yehpaishu, Chifeng; Erchan, Heiho; Changchun, Tailai; Tailai, Taonan; and Huaiyuan, Solun.—*Rengo.*

COMMUNICATIONS

LONG-DISTANCE TELEPHONY.—The Nanking Minister of Communications is reported to be discussing with the Kwangtung Provincial Government authorities a project for a long-distance telephone service to connect Nanking, Shanghai, Canton and Hankow, the principal cities of South and Central China.

SHENSI ROAD WORKS.—Sianfu Reconstruction Board has drawn up surveys for three main roads from Sianfu; to Yulinfu in the north, to Laohokow in Hupeh, and to Hanchungfu in the south. This last road, 250 miles in length, runs entirely through mountainous country and has to climb passes varying from 4,000 to 6,000-ft. The expense of such a road may be imagined. At present there are only two main motor-roads in the whole province; that from Tungkuang to Sianfu, and the problematical one to Lanchowfu, problematical, because the journey by motor-car along it is an unknown quantity, varying from ten to twenty days, or even longer.

MINING

MANCHOUKUO GOLD MINING.—The South Manchuria Railway has been authorized by the Japanese Ministry of Overseas Affairs to invest Y.4,000,000 in the contemplated Manchoukuo Gold Mining Company. The Manchoukuo Government and the Oriental Development Company will also participate. The company will be capitalized at Y.12,000,000, and it will have a monopoly on gold mining in northern Manchoukuo.

NEW GUINEA OIL FIELDS.—A huge government plan for the development of oil fields in Netherlands New Guinea is embodied in a Bill introduced in the People's Council. Contracts will be made for the exploration of 10,000,000 hectares, of which 1,000,000 will be selected for exploitation. The concessionaires include the Bataafsche Petroleum Co., the Nederlandsche Koloniale Petroleum Co., and the Nederlandsche Pacific Petroleum Co. The Royal Dutch and Standard Oil companies are also interested.

AVIATION

AIR LINES IN CHINA.—The Canton-Lungchow and Nanning-Kueiyang air lines are now in full swing following the arrival of four planes purchased from abroad. Altogether, seven new lines are included in the Southwest Aviation Company's plans.

BANGKOK AERODROME.—The Government of Siam announces that it had been decided to link Don Muang with Bangkok by building a road, and further modernize the aerodrome, providing paved runways so that the aerodrome can be used all the year round.

AIRPORT NEAR OSAKA.—A new international airport, costing approximately Y.10,000,000 is to be established by the Japanese Air Transportation Company, the only civil aviation company in Japan, between Osaka and Kobe. The airport will have facilities for both land and sea planes. Establishment of a regular air line between Osaka and Singapore is contemplated.